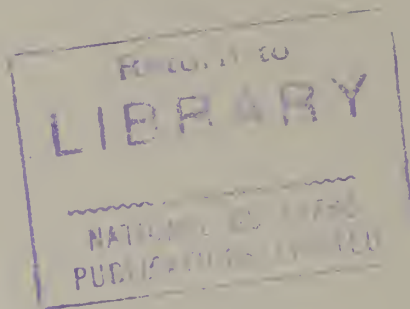


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CANADIAN MINING JOURNAL



VOL. XXXVII

TORONTO

No. 1

IN THIS ISSUE

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of \$5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of \$10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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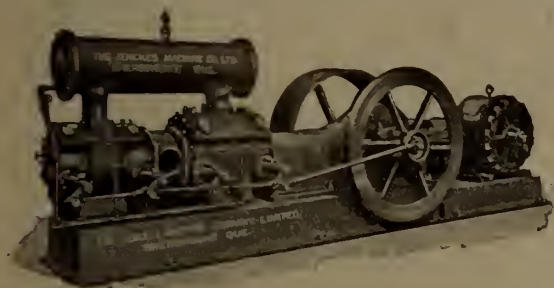
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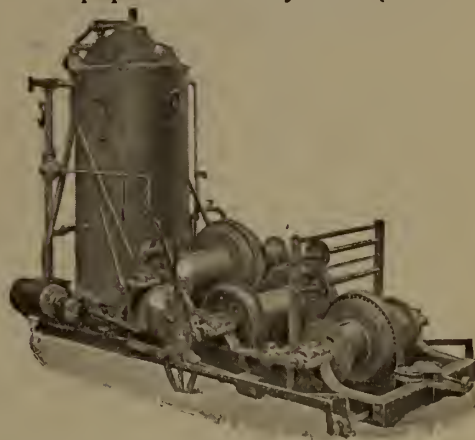
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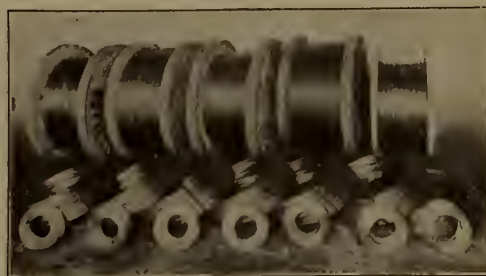
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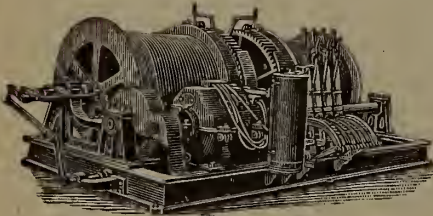
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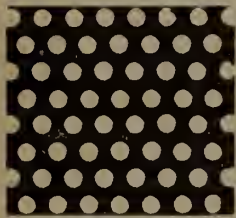
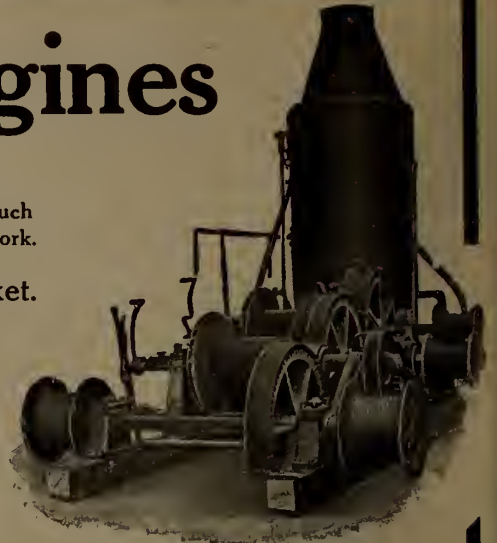
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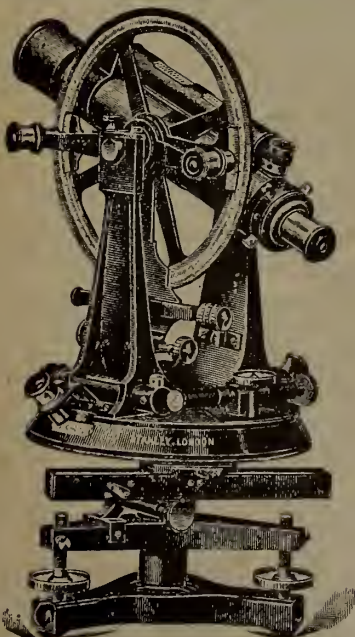
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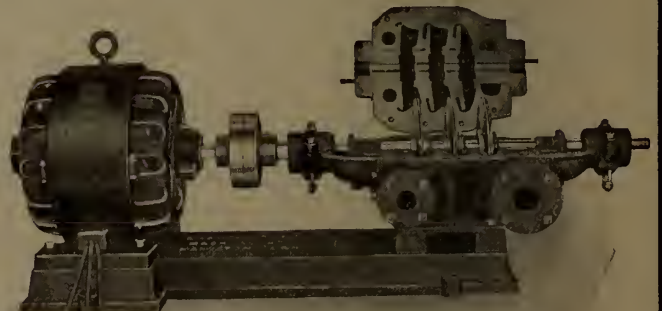
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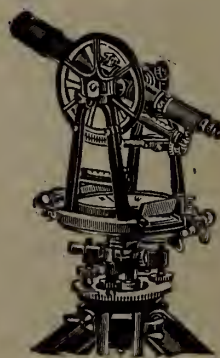
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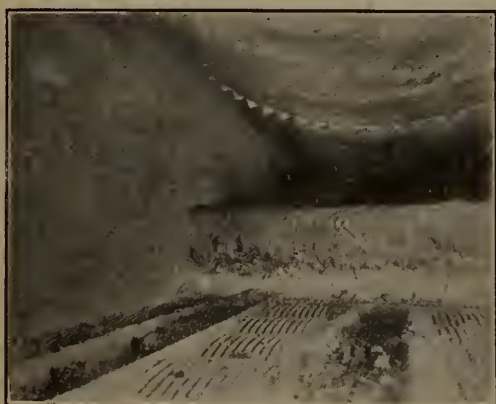
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THE CANADIAN MINING JOURNAL

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GREATER PRODUCTION IS NEEDED

In talking of the cost of the war, Sir George Paish in a recent interview said that Britain's financial loss is mainly in the wealth we fail to create. The actual loss in accumulated wealth has been small.

"We are selling American securities, but we are buying Russian, French and Italian bonds, and on the balance there has been little reduction in our investment since the beginning of the war.

"If each one of us were to live economically during the war we may not need to meet our great war expenses by realizing on our capital. Of course, we shall fail to save during the war the usual \$2,000,000,000 yearly of our income that we use for reproductive purposes."

Canadians will have to pay and are willing and able to pay their share of the cost of the war. It has been estimated by Sir George Foster that the war will cost Canada more than \$20,000,000 a month; but as an editorial writer in the "Mail and Empire" said recently: "Our foreign trade conditions, the Customs returns and the special war taxes have developed most encouragingly. In his budget speech the Finance Minister will be able to show a surprisingly effective raising of funds for current purposes, and at the same time a sharp upturn in general prosperity. The war loan just placed in Canada by the Dominion Government reached the large total of \$100,000,000. The bucket may go several times more to the well, and in every case return filled. If there is a continuation of war order business and full agricultural production in 1916 there is not much reason for doubting that the people of Canada will be able to provide the necessary funds to finish the war. Now that the depression has been shaken off the resourcefulness and vitality of Canada should suffice for the war's financial demands."

The people of the British Empire have made up their minds to go through with the war until victory is won, no matter what the cost, and sacrifices of capital were to be expected. During 1915 the fighting force of Great Britain has been increased from a powerful fleet and a little army to a more powerful fleet and a great army, the latter for a time poorly supplied; but now well supplied with ammunition. The cost of maintaining the army and fleet has increased enormously. It is gratifying therefore to have such a financial authority as Sir George Paish state that the huge expenditure of \$2,000,000,000 annually can be paid out of income and that Great Britain's accumulated wealth remains intact. Apparently the financial

authorities in Great Britain and Canada are convinced that the war can be continued for many years at the present rate of expenditure without necessitating loss of capital.

It is reassuring to have occasionally pointed out to us the magnitude of the financial resources of Great Britain. It is only during this war that most of us have realized how great they are. The recent subscription of over \$100,000,000 by Canadians to the \$50,000,000 war loan is also enabling us to better appreciate what can be done in this country.

Why is it that Canada is in such a satisfactory condition? What are our present sources of wealth? Can they be increased during the war, so that we can stand greater strain if need be?

Our basic sources of wealth are our agricultural soil, mineral deposits, forests and fisheries. Can we advantageously increase production from these sources? Undoubtedly we can and should increase our mineral production.

In the early months of the war there was a falling off in demand for some mineral products that made increased production unwise. In the case of some non-metallic minerals the market is still not strong enough to warrant increased production. But nearly all metals are in demand at good prices, and the market could readily absorb much larger quantities.

During the latter part of 1915 Canada's mineral production has been considerably increased; but it is not yet as large as it should be. A larger production can profitably be made at this time, and operators will be rendering a service to the country generally, as well as taking advantage of a good market, by increasing output. The farmers have helped by increasing productive acreage. Mining men should strive to make new records in 1916.

The apparently long premeditated invasion of Belgium and the horrible manner in which the German plans were carried out will forever stamp the leaders of the Huns as enemies of civilization. Before the war it was hard for Canadians to place much credence in the rumored danger of German aggression. We knew very little of European affairs. That the Belgians were, however, beginning to realize that Germany had sinister motives in their professedly friendly interest in Belgian industries is evident in Professor Ledoux's article in this issue.

Professor Ledoux writes with an intimate knowledge of Belgian affairs and the German invasion. Called suddenly from his work at the University of Brussels he joined the army and became a member of the corps of engineers who assisted in the heroic defence of the Liege forts, and later in the retreat. He took part in the fighting at Antwerp and in the retreat of the remnant of the Belgian army down the

coast. Then seriously ill he was confined to hospital and later declared physically unfit for further military service. He went to England, and then to Canada, where he is now on the staff of the Department of Mineralogy at the University of Toronto. His health is improving and with admirable patriotism he is planning to return again to help defend what is left of Belgium. Later, we trust, he will be able to take part in driving the foe out of his native land.

The effect of heat on the dissolution of gold in cyanide solutions is the subject of a paper by Mr. E. A. Wraight, published in Bulletin No. 133 of the Institution of Mining and Metallurgy. Mr. Wraight carried out a number of experiments, from which he concludes that the effect of heating cyanide solutions is of very doubtful benefit.

It is well known that gold dissolves faster in hot cyanide solutions than in cold. This is an accepted fact with which Mr. Wraight's results are in accord.

Apparently, however, the increased rate of reaction at higher temperature is not of as great advantage as might be expected. According to Mr. Wraight the extraction is increased for a short period, but this is counterbalanced by increased cyanide consumption and subsequent decrease in the rate of dissolution of gold.

Mr. Wraight found, however, that, while oxidizing agents, hydrogen peroxide excepted, are apparently of no value; the addition of oxygen in a more active form, as peroxide or by means of heated air, increases the solvent activity of cyanide solutions in a very pronounced manner.

As was predicted by well-posted authorities a few weeks ago the copper market is stronger than at any time since the war started. It is reported that Anaconda has made a very large sale to the British Government and that Calumet and Hecla is sold out to April 1. These reports lack confirmation, but if true they mean that two of the largest copper producers in the world are finding for their products a ready market at good prices.

ANTIMONY ORE IN ALASKA.

The high price of antimony in 1915 led to the mining of over 800 tons of stibnite ores in Alaska. Nearly 700 tons of this output came from the Fairbanks district, and the rest from Seward peninsula. It is difficult to obtain any exact valuation of the stibnite ores shipped from Alaska. The evidence in hand indicates that the producer received from \$1.25 to \$1.75 per unit of stibnite. It is probably reasonable to estimate that the Alaska shipments sold for \$85 a ton in San Francisco. This indicates a value of about \$70,000 for the total shipments made in 1915.

THE GERMAN INVASION OF BELGIUM, WITH PARTICULAR REFERENCE TO THE MINING INDUSTRY

By A. Ledonx,

Mining Engineer, Professor at the University of Brussels.

It has been often stated and repeated that the principal reason of the present war is of an economic nature. Since 1870, the population of Germany has increased more than that of any other big European country. She is actually of 70 millions. The mean decennial increase per 100 inhabitants, for the period 1870-1900 is 9.23 for Germany, 7.22 for the United Kingdom and only 2.50 for France.

With the large increase of her population, Germany was naturally forced to develop her industrial activities and her external trade. The exports increased from \$1,451,000,000 in 1902 to \$2,671,000,000 in 1911; and in the same time her exports increased from \$1,203,000,000 to \$2,223,000,000.

It might have been supposed that this increase of the external trade would have brought wealth and happiness to Germany; but in fact, only a very small proportion of the people profited by it. The bulk of the population was in a state of perpetual discontent, as is shown by the increasing strength of the "social demokrat" party in that country. A large number of the German population was emigrating every year, to find elsewhere better resources and more liberty. But this emigration provoked by internal discontent was really favoring the German expansion outside.

If we analyze the occupations of the German people, we see that 37 per cent. are supported by industries and mining, 33 per cent. by agriculture and 11.5 per cent. by trade and traffic. Germany is also principally an industrial and mining country. She is producing a large quantity of ores and minerals, but she is nevertheless obliged to import a large quantity of raw material and metallurgical products. This is shown for the principal mineral products by the following figures for the year 1912, in millions:

	German production.	German imports.
Fuel—		
Bituminous coal	174,875,297	10,380,482
Lignitic coal	80,934,797	7,266,116
Petroleum	134,986	1,040,000
Ores—		
Copper ores	969,330	
Copper matte	2,574	23,192
Copper ingots	49,447	200,000
Iron ore	27,199,944	12,120,090
Lead ore	142,839	122,847
Manganese ore		420,709
Pyrite	242,121	1,073,285
Crude tin		15,550
Zinc ore	643,598	293,090
Non-metallic Minerals—		
Potassium salts (kainite, etc.)	11,389,000	
Phosphate rock		902,844
Salt rock	1,352,524	
Chili saltpetre		812,898
Sulphur		42,284
(Sulphuric acid)	1,649,681	130,257

One of the principal aims of modern German policy is to make Germany a country independent of other nations for her supplies in raw material. Minerals cannot be planted and cultivated as wheat; the German country does not contain a sufficient quantity of petroleum fields and deposits of copper, iron, lead, manganese, zinc, pyrite and phosphate. Her coal deposits are worked too actively and new reserves are lacking. The only way for Germany to get such mineral deposits is to steal them from somebody else. That's the German theory in all its crudity. We saw its application after

the 1879 war: the part of Lorraine annexed at that time was just that containing the iron deposits which were then known. Happily for France, those deposits extended at depth into the unannexed territory and discoveries of very important beds were made later on in France.

Very curious postcards and maps representing Europe in 1950 have been published in Germany. On these maps Austria-Hungary, Belgium, Denmark, Netherlands, Northern France, Serbia and a part of Roumania have been incorporated in the German Empire. Such an extension of Germany would have given her the mineral deposits she wanted. In fact, the theory of pangermanism was to create in Europe a new Holy German Empire extending from Calais on the North Sea to the Bosphorus and to take overseas some French colonies and the peace of the British Empire. Although Germany has remained at peace with Holland there is no doubt that if Belgium was to be annexed now, the turn of Holland was to come very soon. The annexation of those two small kingdoms would have given to Germany the big coalfields of Belgium and all the mineral wealth of Dutch East Indies and of the Belgian Congo. It will be to the honor of Great Britain to have prevented the realization of such a diabolical scheme.

Although the German emigration to America was becoming every year more important, people of the new Continent do not seem to be well acquainted with the methods employed by the German in order to capture a country. It should not be thought that the invasion of Belgium started the 4th August, 1914, with the beginning of the war. The German invasion of Belgium is much older, but was not started in the military way. Numbers of Germans of all ages and of all classes had arrived in Belgium long before the war and were residing there. In the big Belgian towns such as Antwerp, Brussels and Liege they were so numerous that they succeeded in establishing there German schools. This is a fact to be held in consideration, the Germans residing in other countries remain Germans and although sometimes naturalized they are not losing their national character with its qualities and its faults. Their children must be educated by German system and German pedagogy. And so they hope to constitute a small state, in the country receiving them. The actual experience of the United States is conclusive in this regard.

Most of the young Germans arriving in Belgium were entering tradehouses or factories, generally as simple volunteers. But when they were acquainted with their employer's organization, they asked for big salaries or went away, very often it was in order to open in the same town an opposition business. If there was an opportunity to invest money in their employer's business, the German clerk was generally ready to do so and the big banks of his country were supporting him. In other cases a more simple way to Germanize a Belgium firm was to marry the employer's daughter, and this has also often occurred.

Before Germany declared war the number of German industrial and commercial establishments in Belgium was increasing tremendously in number and importance. Big branches of German banks had been opened in Antwerp and Brussels. The German navigation lines were using Antwerp as a German harbor. To compete with the Belgian zinc industry the firm Beer, Sondheimer & Co., of Frankfurt had established in Belgium very large smelting plants. The German banks were monopolizing the shares of big mines and factories, buying at the stock exchange all they could get. At some annual meetings of shareholders of Belgian companies, the Belgians were astonished to see that the majority of the shares were in German hands. Quite recently the Germans were also trying to Germanize the Belgian Congo and principally the province of Katanga which is the richest in mineral deposits.

The Germans introduced into Belgium, brought with them a strong faith and attachment to their "vaterland." When it was possible for them to recommend products of Germany, they did never fail. We have known big Belgian factories, managed by Belgians, but having in their staff two or three Germans, where all kinds of goods, from the stationery and the laboratory apparatus to the big electrical machinery were ordered in Germany. For the Teutons nothing is of good quality except that which comes from their country. Really most of the German products are rubbish, attractive for their low prices, but not resisting the test of time.

The international exhibition at Brussels in 1910, showed to what an extent these German activities had undermined the whole Belgian trade and industry. The German department was a very large one, very well presented and interesting. The Germans and the Kaiser himself came to their "dear friends of Belgium" to express to them the extent of their sympathy and their desire to continue peaceful relations with Belgium. But the Belgians were warned by that exhibit of German expansion, and in themselves they felt that it was time to pay attention to these armed neighbors who talked too easily of peace.

Time has passed: on the 2nd of August, 1914, the German ambassador in Brussels was yet answering the Belgians that they had nothing to fear from Germany: "perhaps the house of your neighbor will burn, but yours will not suffer," were his own words. In the meantime the German Army Corps were crowding along the Belgian border. Two days later the invasion began, systematical and coolblooded.

The Belgians had to learn strange things about the work that the Germans had done in their country before the war. All the works of defence of Belgium had been carefully studied by German spies. Certain of these were naturalized Belgians and had been in the Belgian army. The work of offensive of the Germans in Belgium had long since been prepared. In the vicinity of the Belgian fortified towns, the Germans had built up factories, and in those factories,—whose position with regard to the forts had been accurately determined,—big concrete foundations had been prepared to receive the big German siege-guns. Preparations of the same kind had been established on the Belgian coast. There at numerous summer resorts, large numbers of German families were coming every year. Who could suppose that some of them had other intentions than to find their health and comfort? Nevertheless, German engineers had built in summer

cottages concrete works to receive the artillery of the Teutons.

I remember to have seen in Belgium before the war, blue advertisements for ultramarine to which we paid no peculiar attention; but after the war had started it has been noticed that they had been fixed by Germans and only along the roads leading to Antwerp. They were destined to indicate the way to the invading troops! Really the German sympathy in peacetime for their "dear friends of Belgium" was of a very special kind.

After the capture of the forts of the Meuse and the fall of Liege and Namur, centers of two large industrial and mining districts, the German military authorities organized their conquest. All the big mines and factories were occupied militarily. A similar occupation was made later on in the other Belgian coal fields.

The Germans proposed that the employees of Belgian mines and factories should work for them. From the managers to the most humble workmen, all refused. Difficulties arose with the mining people; the Germans sent in those districts lots of soldiers; trenches were dug in the streets of the "corons,"—the name given in Belgium and France to the agglomerations of work people houses in mining districts,—and in those trenches, machine guns were placed. The workmen were made prisoners and in some localities placed two days in cattle trucks, without having anything to eat. Afterwards some of them were obliged to work on roads and railways, under the steady threat of a German soldier's rifle.

The inactivity of the mining population could not last always; when they were quite starved out, they were obliged to return to their pits and to work. The newspapers have frequently stated how terrible was the situation of the Belgian people under the rule of the German invaders. Let us now see how their arrival affected the industry in the country.

It is easy to understand that the Belgian factories must be very much affected by the war. Before the war the total trade of Belgium amounted to \$1,620,000,000 or \$216 per head as compared with \$120.75 for Canada, \$114 for the United Kingdom, \$70.75 for France, \$67.25 for Germany and \$40 for the United States. This high standard of the total trade of Belgium per head, gives an idea of the industrial activity of that country. Necessarily it was principally based on her exports. Actually all her harbors are blockaded and trade with foreign nations has become an impossibility. As a consequence a lot of factories are closed and the working population without resources.

In his latest speech to the Reichstag, the German Chancellor held that the production of coal in Belgium during the three last months had reached 3,000,000 tons. In normal times the production should be 6,500,000 tons, so the reduction is more than 50 per cent.

Although no exact data are available, the reduction must yet be larger in the numerous quarries of Belgium. In ordinary time they number 1,700 and employ 40,000 workpeople. Building stones have for the present no market in Belgium and the sand for glass factories has no use as most of the furnaces are idle.

Woollen, linen, and rubber industries are completely stopped for lack of raw material and several zinc smelters have been obliged to cease operations.

In normal times Belgium produces 205,940 metric tons of zinc (1912), or more than one-fifth of the world's total production. She is only surpassed by

the United States and Germany. Now that big industry is arrested because exports are impossible.

And so we could go on, examining every industrial branch particularly. The war has paralyzed Belgian industry and it will take time for Belgium to recover.

Miners know that the arrest of continuous work in certain mines may occasion losses from which it is difficult to recover, and such is the case for the Belgian mines. Pumping being stopped some levels are flooded, and in the case of mines whose financial situation was not all too bright it may mean stopping for ever. Then also the lack of renewal of timbering will cause falling and caving in many mines.

New large coalfields had been discovered in the north east of Belgium and in most of the concessions the pits were actually being sunk. The work was not easy; before reaching the coal measures, the miners had to pass through 1,500 feet of clay and sand, the latter being always very wet. The processes of freezing and cementing had been applied with success. In most of the workings, the sinking was only half done, and since the beginning of the war all the work has been stopped. At the taking up of those sinkings, new soundings will be necessary and a lot of work that had been achieved will be wasted. It would be difficult to give now in figures the amount of the losses of all kinds that the war has imposed on Belgian mining and industrial companies.

Along with the losses produced by the decrease or stopping of work, destroying of large industrial plants has also to be noticed. During the bombardment of Liege, Namur and Antwerp, the German artillery destroyed the installations of mines and of great factories, without any strategical necessity.

Later on, when the Kaiser's armies had taken about the whole industrial part of Belgium, another system was inaugurated. In the big steelworks of John Cockrill at Seraing near Liege, a great part of the machinery has been dismantled and sent to Germany. All the copper available in Belgium's electrical works and other plants has been taken and directed to Germany.

The manner in which the Teuton officers performed this part of their programme is interesting. In one of those factories a Prussian captain entered the office of the manager, revolver in the hand. The Belgian manager, who spoke very good German, told him in this language that it was not a very civilized way to enter anybody's room. The officer replied that he was not a poet but a soldier, that he had nothing to do with that childish sentimentality, but that he wanted all the copper which was in the factory.

After all that has been related about cruelty of the German soldiers with regard to children, women and old people, this lack of respect for the civilian or industrial property will not seem astonishing. The atrocities committed in Belgium have sometimes been considered as isolated facts or the fault of soldiers intoxicated by the rage of the battlefield. If this was true that spirit of destruction, murder, robbing and exhaustion would have vanished when the Germans were masters of the greatest part of Belgium. The preceding facts show that the invasion of Belgium has been performed systematically along the lines of a long prepared scheme. The Teutonic staff thought it necessary for their glory and safety to terrorize the people remaining in the country they had conquered, to destroy the strength of Belgium's industry, to reduce her people to poverty and starvation. All those aims have been realized and nevertheless, Belgium although

bleeding and martyred is not dead; she remains hopeful and looks at the coming new year as a year of revenge and liberation. She is proud to have been the first in that list containing northern France, Poland, Serbia and Armenia to suffer for the destruction of militarism.

From these facts we can draw an interesting moral for people, such as Canadians, who want to make their way by honest labor. Industry and militarism are two opposite concepts: the first involves a perpetual work of creation, building up and invention; the second is a perpetual work of destruction. To nobody this will appear more true than to those people interested in mining and who strive all their lives to increase the potential wealth of humanity. When war breaks out, militarism destroys in a short time all that industry has raised by years of patient and continuous labor. Therefore we are more interested than anyone else in the destruction of that spirit of conquest, characterizing the German race. It is not only the interest of Belgium, of Serbia and the other people who were crushed by the Germans; it is the interest of the whole world.

ALUMINUM.

The consumption of aluminum in the United States in 1914 was the largest on record and amounted to 79,129,000 pounds, valued at \$14,523,000. Sixty years ago aluminum was a chemical curiosity, valued at \$90 per pound. The total amount produced in 1883 was 83 pounds. About 1889 it was selling in the United States at \$4.50 per pound, and the output was 75 pounds per day. With cheapened electric power and improvements in manufacturing processes, due to the genius of men like Charles M. Hall, the metal has ceased to be a "chemical" and its uses and applications are growing. At the end of 1914 it was selling at 19 cents a pound, but now, owing to the great demand, it is worth 60 cents a pound.

The consumption of metallic aluminum in the United States is much greater than the output and, though some metal is exported, a much larger quantity is imported. Much secondary aluminum is recovered from one source or another, largely from scraps, borings, and turnings. This recovered aluminum amounted, in 1914, to 6,253 short tons, or 12,506,000 pounds. The consumption of the metal is growing rapidly and the facilities for turning out enough for home consumption are inadequate. The one concern manufacturing the metal in the United States has steadily expanded its plant capacity in recent years, and has recently acquired an immense plant capable of generating 100,000 horsepower at Whitney, N.C., financed by French capital, but on which work had been suspended.

The great increase in the consumption of metallic aluminum has been determined by the peculiar properties of the metal, especially its lightness. Commercial aluminum has a specific gravity of about 2.7, whereas the specific gravity of brass is about 3 times as great, that of steel about 2.8 times as great, and that of copper approximately 3.3 times as great. Hence the metal has been in demand in the manufacture of automobiles, aeroplanes and dirigible balloons.

Aluminum vessels are coming into use in the brewing industry, varnish manufacture, the preparation of food-stuffs, the soap and candle industry, the refining of sugar and fatty and vegetable acids, and in the manufacture of high explosives, because of its ability to withstand the action, either separately or combined, of sulphuric and nitric acid.

THE COAL TRADE OF NOVA SCOTIA IN 1915

A RESUME

By F. W. Gray

The production of the coal mines of Nova Scotia during 1915 was practically the same as the yield of 1914. The writer estimated the production of 1914 as having been at least one million tons less than the full output capacity of the mines, had full operation been possible.

Since the autumn of 1913 there has been an almost complete suspension of new development work and capital extension at the collieries. In the interim several old collieries have become exhausted and have been permanently closed, and mining in unprofitable sections of collieries still operating has been discontinued. Several serious underground fires in the Pictou and Cumberland fields occurring during the last three years have caused the temporary, and in some cases the permanent loss of the mine districts affected.

Because of these various causes, the output capacity of the collieries is now lessened and the actual yield of 1915 is probably not more than 600,000 tons below the full output capacity of the mines, under the most favorable circumstances. In reviewing the outputs of 1914 the writer stated that "Not one of the operating coal companies in Nova Scotia is in a position to very materially increase its production over the figures of 1913," and since the date of this statement the number of collieries in active operation has been still further diminished.

It is therefore apparent that a serious shrinkage of the output capacity of the coal mines of Nova Scotia has taken place and the causes which have given rise to this recession of productivity will continue to operate for several years to come, independent altogether of considerations of market demand and labor supply.

When, however, there is combined with this lessening of capacity an increased demand for coal and a most serious reduction in the labor supply, it may be expected that a decided coal shortage will follow, and indications are now pointing to a temporary excess of demand over supply in the coal market.

The condition is an artificial one and has been brought about altogether by causes incident to the war. Moreover the duration of present conditions is quite uncertain and the prolongation of the present brisk demand for coal is too problematical to warrant any large expenditure on capital extensions by the coal companies, even were the labor available or in sight.

The most noteworthy feature of the year has been the response of the miners to the call for recruits. The writer, in the Canadian Mining Journal of 15th August last, gave some statistics concerning recruiting among the miners, and in another section of this article these statistics are corrected to the end of November. There has been some disposition to question the accuracy of these figures but it may be stated that the tabulation given is as correct as it is possible to make it and errs on the side of incompleteness rather than of exaggeration.

The record of the Nova Scotian miners in answering the call of King and Country is a noble one, one that in years to come will be a continuing source of

proud memories to themselves and also to those who have the honor to be associated with them.

But the drain upon the industry has been a severe one. The drop in production has assumed very serious proportions, and, as the writer ventured to forecast a few months ago, the question of recruiting among miners is resolving itself into a choice between men and munitions.

Enlistments to the end of November total 3,075 men, equal to 21 per cent. of the total force of 14,500 workmen* employed at the beginning of the war in and about the collieries. The Dominion Coal Company and the Nova Scotia Steel and Coal Company have between them lost 2,500 men by enlistments. Each of these companies is largely concerned in supplying coal for steel making, and both in the case of the Dominion Iron and Steel Company and the Scotia Company the output of steel is to-day almost altogether in the shape of munitions material.

The great railways of Canada now occupied in transporting troops, grain and munitions; the large fleets of transports that constantly ply between Canada and Great Britain; the mail steamers, the converted cruisers that patrol the Atlantic seaboard of North America; the factories in Montreal and Eastern Canada, occupied in manufacturing such materials as rifle sights, shells of various kinds, clothing, underwear, leather goods, boots, etc., all these are dependent on coal mined in Nova Scotia. The men who have gone cannot be replaced until the conclusion of war, and the reduction in the output of coal is, and will continue to be, in direct proportion to enlistments among the workmen at the collieries. This question of recruiting among miners is one that has already received the anxious attention of British and French statesmen, and in both countries special action has been found necessary to preserve the output capacity of the coal mines. The attention that has been paid by the Great General Staff of the German Army to the questions of coal and steel production is well known to all mining engineers who have followed the development of hostilities. It must be admitted that coal is as necessary to our final victory as any other munition. One might go further and say it is more necessary, because coal is the foundation of all manufacturing activity.

In England the hours of schools have been shortened in order to save gas, and reduce thereby the consumption of coal.

The availability of coal for the manufacture of munitions in Canada seems often to be taken for granted. In the Canadian Mining Institute Bulletin for December there is a brief but illuminating article by Hon. Col. D. Carnegie, dealing with the activities of the Shell Commission. A list of the materials used in the manufacture of shells is given, namely, steel, brass, copper, lead, tin, resin, powder, cordite, and trinitrotoluene, but coal is not mentioned by name. Its use is of course implicit in every single item of material mentioned. In the period covered by Col. Carnegie's remarks 360,000,000 pounds of steel has been used in

*See Mines Report Province of Nova Scotia 1914.

shell manufacture in Canada. The fabrication of this quantity of steel necessitates the consumption of at least 640,000 tons of coal. Trinitrotoluene, the consumption of which is given as 11,000,000 pounds, is a direct coal derivative, at least so far as the un-nitrated toluene is concerned.

There is no need to further elaborate this point. It has already been done in an inimitable manner by David Lloyd-George. Without coal the manufacture and the transportation of munitions is impossible.

The following table gives the annual production of the various coal companies of Nova Scotia over a period of five years. Inspection of the figures will show that, notwithstanding all the drawbacks to production previously pointed out, the coal raised in 1915 is slightly in excess of the outputs of 1914, a better showing than was to be hoped for, seeing that at the end of June the provincial output was 426,000 tons behind the first half of 1914.

The percentage of output to the credit of Cape Breton increases steadily from year to year, and may be expected to continue to do so.

The tonnage of the Dominion Coal Company in 1915 reached 75 per cent. of the entire provincial output,

per cent. from amongst this Company's employees. The Maritime Coal & Railway Co. had the largest output for a good many years. During the last three months this Company's production has averaged over 17,000 tons per month. The Colonial Coal Company also show a slight increase over last year, although this Company now is operating one colliery, having closed down the "MacKay" mine.

The coal output of Inverness County is steadily dwindling. The falling off in the output of the Inverness Coal & Railway Company occurred during the first six months of the year. In the closing months a production of 25,000 tons per month was being obtained.

The reduction in the production of the Nova Scotia Steel Company also occurred during the first five months of 1915. During the last half of the year this Company's mines have been on full production, and are averaging about 62,000 tons monthly.

The production of the Dominion Coal Company exceeded that of 1914 by some 300,000 tons, the output of the Springhill Mines showing a slight decrease. In comparing the outputs of this Company with those of 1914 it must not be forgotten that in 1914 the mines could easily have produced a million tons more than

Yearly Production of the Coal Companies of Nova Scotia.

	1911.	1912.	1913	1914.	1915.
Dominion Coal Co.—					
Glace Bay Mines...	3,895,000	4,513,269	4,739,149	4,287,717	4,610,000
Springhill Mines ...	266,000	419,096	381,414	417,416	400,000
N. S. Steel & Coal Co.	780,000	841,528	813,877	752,153	618,000
Acadia Coal Co.	370,000	435,654	536,000	394,000	336,000
Inverness Coal & Ry.	281,000	279,318	293,847	264,843	244,000
Intercolonial Coal Co..	263,000	235,859	189,550	213,000	178,000
Maritime Coal & Ry..	160,000	140,000	158,847	142,000	173,000
Minudie Coal Co.	105,000	60,000	65,500	70,000	86,000
Colonial Coal Co. ...	30,000	36,897	65,844	53,134	56,000
Cape Breton Coal, Iron & Railway Co. ....	.....	.....	8,424	49,000	6,000
Total	6,250,000	6,961,619	7,252,452	6,643,263	6,707,000
Cape Breton Island ..	5,000,000	5,671,012	5,921,141	5,406,847	5,534,000
Per cent.	80%	81%	81%	81%	82½%
Nova Scotia	1,250,000	1,290,607	1,331,311	1,236,416	1,173,000
Per cent.	20%	19%	19%	19%	17½%

and this preponderance may also be expected to still further increase.

The Springhill mines during the year were able to overcome the effect of the underground fire that occurred in 1913. The Allan Shafts of the Acadia Coal Company were successfully recovered but did not produce much coal until the last half of the year. The Drummond Colliery was doing very well indeed, but unfortunately a fire broke out in November which has necessitated the sealing of the mine and the flooding of the affected area. The time that will be occupied by the recovery operations is uncertain, but it will probably be one or two months.

With the exception of the mines in the Joggins Field all the Pieton and Cumberland collieries show decreases in output. The strength of the smaller companies is worthy of remark. The Minudie Company again show an increase, notwithstanding an enlistment of 26

was actually mined, whereas during the last half of 1915 the collieries have been working to the fullest capacity.

The highest monthly production yet obtained by this Company was 462,240 tons in June. No. 2 colliery put out 80,933 tons in July, the highest mark reached by this large colliery. During the year No. 3 colliery became exhausted and was closed down. No. 17 colliery has not been operated during the year. No extensions or new development work took place during the year. A new turbo-compressor plant is on order for the Springhill Mines, it being the intention to use compressed air for pumping and auxiliary haulages underground.

The number of enlistments from among the employees of the various coal companies of Nova Scotia, to the end of November, is, accurately as it is possible to determine, as follows:

	Enlisted among Forces of the Allies	Enlisted with British Forces
Cape Breton Island—		
Dom. Coal Co.	540	1,017
N. S. Steel & Coal Co.	25	531
Inverness Coal & Ry. Co.	17	60
Colonial Coal Co., etc.	..	20
	— 582	— 1,628
Nova Scotia Mainland—		
Springhill Mines (Dominion Coal Co.)	140	256
Intercolonial Coal Co.	1	118
Acadia Coal Co.	20	115
Minudie Coal Co.	18	66
Maritime Coal & Ry. Co.	1	130
	— 180	— 685
Total for the Province....	762	2,313

The men shown as having joined the forces of the Allies were of French, Belgian and Italian nationality. Practically no Frenchmen or Belgians of military fitness remained in Nova Scotia. The enlistments since the date of the last figures given in the Journal have been exclusively from among men of British nationality, that is to say, since the end of June last, 1,325 men have left the collieries of Nova Scotia for the front. The proud Gaelic motto of the Nova Scotia 85th Highlanders, which is translated as "The breed of manly men" might fittingly be bestowed upon the miners of Nova Scotia. Nor should a lesser tribute be paid to the wives and mothers of the mining population, who, more than is probably recognized, have helped their menfolk in their great resolve and supreme sacrifice.

Shipping Matters.—St. Lawrence shipments were lower than in 1914, the decrease being attributed to the shortage of shipping. The Admiralty requisitions have greatly limited the available freighting tonnage. At the beginning of the St. Lawrence season the Dominion Coal Company had lost no less than fifty-five per cent. of its season-chartered tonnage by Admiralty requisition, and in addition this company lost at sea the chartered vessels "Kron Prins Olaf," "Easington," and "St. Kilda," and its own two vessels the "Cacouna," and "Cabot."

Some years ago the Canadian Government passed regulations which barred vessels of Norwegian and other alien nationalities from trading in Canadian waters unless they transferred to Canadian or British register. This regulation was doubtless conceived with the idea of fostering a Canadian-owned mercantile marine, but no steps were taken apparently to encourage or subsidize the building of ships in Canada. It has been found necessary to modify the exclusion of Norwegian tonnage to some extent because of the difficulty of getting suitable British or Canadian-owned vessels, but the regulation has had the effect of lessening the number of neutral vessels employed in the Canadian coasting trade and increasing the number of British-owned vessels. Neutral vessels could not have been requisitioned by the Admiralty, and but for the regulation referred to it is probable that more neutral vessels would have been employed in the coal-carrying trade, and freights would not to-day have been so badly affected. It is curious that a regulation intended to foster a home-built and Canadian-owned

marine should have really worked against Canadian interests under present circumstances. The regulation has merely had the effect of substituting English or Scotch owners for Norwegian owners, and has not assisted in the slightest degree in bringing into being a Canadian mercantile marine. In any case, whether these chartered vessels are Norwegian-owned or British-owned, they are all built in Great Britain, so that the regulation has not helped the British ship-building industry either.

One outcome of the war will be the advertisement given to Nova Scotian coal. Because of the difficulty of obtaining coal in Great Britain, steamers on the trans-atlantic route have been taking double bunkers on this side. The large auxiliary cruisers, including such leviathans as the "Mauretania" have been bunkered with Nova Scotian coal. Ships from all the ends of the earth—vessels that in palmier days would have scoffed at any grade of bunker below that of "best Welsh"—have used Nova Scotian coal, with excellent results.

The writer cannot forbear referring to the standing miracle of the unmolested and uninterrupted coastwise trade of Nova Scotia during the progress of seventeen months of war with the second greatest naval power in the world. Our everyday immunity from hostile attack from the sea is now a commonplace and accepted circumstance, but it is none the less a thing to marvel at.

USES OF PLATINUM.

Probably one of the most important uses of platinum at the present time is in the manufacture of "fuming" sulphuric acid and sulphur trioxide, materials that are practically indispensable to the makers of high explosives and aniline colors. It is not possible to estimate the quantity of platinum tied up in the manufacture of sulphur trioxide, but the loss of platinum in the industry is very small. Should the price of platinum prohibit its use, sulphuric acid manufacturers could still make the fuming acid by substituting iron oxide for platinum.

In former years platinum was considered essential in electrical work where it is now replaced by "nichrome" and other alloys or metallic molybdenum and tungsten. In dental work, platinum plating gives as satisfactory results as the pure platinum formerly much used.

USES OF QUICKSILVER OR MERCURY.

The principal uses of quicksilver are in the manufacture of fulminate, in making electric appliances and in the milling of gold and silver ores. The quantity of quicksilver used for the latter purpose is much less than formerly because of the growing use of the cyanide process. Consequently more quicksilver is available for use in the manufacture of explosive caps and electrical appliances. More than 30 per cent. of the gold mined in the United States is recovered by cyanidation, and only about 21 per cent. by amalgamation, the total amount of quicksilver used for the purpose amounting to only 700 or 800 flasks a year.

The average gold recovery from 11,000,000 tons of siliceous ores treated in the United States in 1914 was \$5.53 per ton. The average gold per ton from the Alaskan deep mines was \$2.78; from California, \$5.46, and from South Dakota, \$3.63. Even with these low recoveries of gold per ton of ore, the dividend yield has been large.

MINING IN QUEBEC DURING THE YEAR 1915

By Theo. C. Denis.

As far as an estimate can be made, the figures of the mineral production of the Province of Quebec during 1915 will show an appreciable decrease as compared with the previous year. This falling off, however, will not be as large as it would have been had the second half of the year resembled the first six months.

The vast majority of the products of the mines and quarries of the Province of Quebec is non-metallic in character,—being principally made up of asbestos and structural materials. The metallic products of our mines only enter for less than 9 per cent in the figures of our mineral production. It is therefore natural that such products that are in demand mainly in times of industrial prosperity, should show a falling off in these times of abnormal economic conditions. Such are: Asbestos for structural purposes and manufacture of heat insulating coverings; mica for electrical apparatus; building materials, limestone, cement, marble, brick.

On the other hand, the metallic mines enjoyed an activity unprecedented in their history. As the European situation has created a demand for most metals at most attractive prices, this has had the effect of stimulating the re-opening of our chromite and molybdenite deposits, and of greatly increasing the production of our copper and sulphur ores.

From January until May, the outlook for the asbestos industry was rather dark. Many of the mines suspended operations during the whole winter, limiting the work to pumping the water out of the pits. But activity began to develop in the early part of the summer, and, as a matter of fact, the shipments of asbestos will only show a decrease of perhaps 10 per cent. At present, the asbestos market is practically normal and the demand is good. The acuteness of the situation during the first months of the year may be gathered from the fact that the wages for unskilled labor in the asbestos districts were \$1.25 and even \$1.00 in January and February, whereas now, in December, they are \$1.75, which is the normal standard.

The greater part of the chrome which can be mined in New Caledonia and in Rhodesia is required in France and England; moreover ocean freight is very difficult to obtain, and the rates are abnormally high. Under these conditions, it is quite natural that the demand for Quebec chrome in the United States should be very brisk and result in the re-opening of our chrome mines, which had laid dormant for several years.

It is estimated that during the last six months of 1915 some 10,000 tons of chrome ore, of an average content of probably 30 per cent. chromic sesquioxide, have been exported from Black Lake and Coleraine. It is not at all impossible that, from this galvanization of an industry which was flourishing a few years ago, permanent results may follow.

All previous records of shipments of copper and sulphur ores will be broken, and this despite the fact that the shipments of ore from the Eustis mine have been handicapped by the burning down of the concentrator, which occurred in August. Immediate steps were taken for building a modern and up-to-date concentrator. Some of the monthly shipments of the Weedon mine have neared 10,000 tons.

Substantial shipments of zinc and lead ore are recorded from the deposits of Notre Dame des Anges, in Portneuf county. These deposits are proving to be im-

portant and interesting. Dr. J. A. Bancroft made a study of these occurrences during the field season, for the Quebec Mines Branch, and the results of his field-work will be published in the annual report of the Branch.

The mica and the graphite production, from the Lievre and Gatineau Rivers district, will show a considerable decrease, but this will be compensated, to some extent, by an increase in the production of magnesite.

In 1914, the total mineral production of the Province of Quebec reached \$11,732,782, made up, roughly speaking, as follows: Asbestos, 25 per cent.; structural materials, 62 per cent.; metallic ores, 9 per cent.; miscellaneous, such as mica, feldspar, magnesite, 4 per cent. A large decrease in building materials is to be expected, but it is gratifying to note that our asbestos industry has picked up so well during the latter part of the year and there is little doubt that on resumption of normal industrial and economic conditions, the mineral production of the Province of Quebec will resume the regular growth and increase which, until last year, each year had shown over the preceding one.

ANTIMONY.

The demand for antimony caused by the European war has resulted in the opening of many deposits in various parts of the world. The element is almost indispensable in type and bearing metals, and there has been a great demand for antimony to be used in making shrapnel bullets. Antimony used in America has been mostly obtained from China and Mexico.

MANGANESE.

Prior to 1870 iron found its principal use as wrought iron and crucible steel in which manganese is not used. The development of the Bessemer process about 1870 created a demand for manganese alloys, and manganese now constitutes about one-half of 1 per cent. of all Bessemer and open-hearth steel. Manganese also forms a large part of some special alloys used in the manufacture of grinding and crushing machinery that are highly important in modern industries.

CHROMIUM.

Although the salts of chromium have many minor uses, the metal finds its greatest use as an alloy with iron in the manufacture of high-grade steel for the most part uniquely adapted to special uses. Tool steel containing small amounts of chromium and tungsten permits a rate of cutting not possible with any other alloys and is therefore important in modern machine-shop practice.

Three thousand four hundred and thirty ounces of refined platinum were recovered in the United States in 1914 from the electrolytic refining of gold bullion, platinum sands and copper matte. The platinum recovered by gold and copper refiners occurs in the original ores in such minute quantities that it is rarely determined in assaying. Only the immense tonnages of gold, copper and silver ores treated annually render the platinum content of importance.

CONSOLIDATED MINING & SMELTING COMPANY OF CANADA—ANNUAL REPORT

President W. D. Matthews' report for the year ending September 30th, 1915, is in part as follows:

The net profit after writing off \$192,478.85 for depreciation amounts to \$795,411.15, out of which four dividends (a total of 8 per cent.), amounting to \$464,398.00, have been paid, leaving a balance of \$331,013.15, which, added to the balance at the credit of the Profit and Loss Account as shown last year, makes a total of \$2,058,299.88 at the credit of that account.

During the year the Property Account has been increased by the sum of \$42,372.37, which includes the cost of claims adjoining the Sullivan mine and work done on the Lucky Thought, Ottawa, Molly Gibson, Highland and Silver King mines.

As outlined in a notice to the shareholders on November 15th last, the directors decided to issue 11,610 shares of the stock of the company. This new issue of stock was for the purpose of providing funds for the extension of the company's operations at Trail and elsewhere.

The directors being of opinion that further issues of capital may be required for the purposes of the company have passed a by-law, increasing the amount of the authorized capital to \$15,000,000.00.

Since the last report important additions have been authorized at the smelter, to take care of an increased tonnage of ore and also to allow of the production of zinc on a commercial scale and to provide a copper refinery. These additions and extensions are well under way at the present time and some of the equipment is already in operation.

Contracts have recently been entered into with the Shell Committee for the supply of a considerable tonnage of zinc and refined copper. The manufacture of zinc is a new departure for the Company, but with the large tonnage of zinc ores available in the company's properties it will develop into an important feature of its operations. Up to the present the copper matte coming from the smelter has been refined in the United States, but the refinery when in operation at Trail will enable the company to refine copper in Canada.

The development work at the Sullivan mine, and also at the Rossland group, has opened up some promising bodies of ore. Very little work has been done at the other properties of the company.

Balance Sheet as at September 30th, 1915.

Capital—	Liabilities.
Authorized:	
75,000 Shares of \$100 each	\$7,500,000.00
Issued and fully paid—	
58,052 shares of \$100 each	\$5,805,200.00
Sundry Banks—	
Bank of Montreal—	
Loan and overdraft	\$664,461.57
Accrued interest	2,881.30
Pay roll accounts overdrawn	1,742.85
	669,085.72
Contingent liability at September 30,	
1915, on drafts against shipments.	\$184,485.20
Accounts payable and unpaid dividends.....	528,007.90

Reserve, including provision for claims awaiting adjustment 24,552.57

Profit and Loss Account—

Balance at September 30, 1914....	\$1,727,286.73
Profit twelve months ended September 30, 1915	795,411.15
	<u>\$2,522,697.88</u>
Less dividends declared Dec. 15, 1914,	
March 10, June 10 and Sept 10,	
1915	464,398.00
	<u>2,058,299.88</u>
	<u>\$9,085,146.07</u>

Assets.

Mines, Mineral Claims and Shares in Other Companies—	
Balance September 30, 1914.....	\$5,290,396.91
Expenditure, twelve months to September 30, 1915	42,372.37
	<u>\$5,332,769.28</u>

Mining, Smelting, Concentrating and Refining Plants—	
Balance September 30, 1914.....	\$1,882,615.24
Construction, twelve months to September 30, 1915	334,909.14
	<u>\$2,217,524.38</u>
Less depreciation	192,478.85
	<u>2,025,045.53</u>

Smelter Product on Hand and in Transit to Refineries—	
Pig lead, bullion, matte, bluestone and antimony	\$179,448.47
Ores and Metals on Hand and in Transit to Smelter at September 30, 1915—	
Value of metal contents corrected to market quotations:	
Ores on hand	\$525,899.60
Refinery metals on hand.	410,942.17
Ore in transit to smelter.	30,023.15
	<u>966,864.92</u>
	<u>1,146,313.39</u>
Mine and smelter stores and materials.....	414,283.87
Accounts receivable	146,169.11
Insurance and taxes paid in advance	15,926.33
Cash in Banks and on hand—	
Head Office, Toronto	\$1,831.91
Sundry pay roll bank accounts ..	2,806.65
	<u>4,638.56</u>
	<u>\$9,085,146.07</u>

Profit and Loss Account.

For the Twelve Months Ended September 30th, 1915.	
To smelter product on hand and in transit from smelter to refineries at Sept. 30, 1914	\$133,492.80
To ores and metals on hand and in transit to the smelter at Sept. 30, 1914	1,319,758.45
To Customs ore, lead and bullion purchased	1,400,000.43
To freight on ore from company's mines	151,442.94

To Mining, Smelting and General Expenses—	
Molly Gibson Mine	\$2,614.36
Richmond-Eureka Mine	245.35
Maestro Mine	106.64
Highland Mine	2,556.72
No. 1 Mine	22,632.70
St. Eugene Mine	8,166.05
Sullivan Mine	113,183.67
Le Roi Mine	352,831.80
Centre Star Mine	602,766.46
No. 7 Mine	1,342.72
Ben Hur Mine	17,194.12
Trail smelter and refinery	1,940,075.65
	<u>3,063,716.24</u>

To Development Expenses—	
Ottawa Mine	\$1,826.06
No. 1 Mine	11,721.47
Sullivan Mine	59,261.66
Le Roi Mine	74,001.14
Centre Star Mine	288,311.49
Silver Dollar Group Mines	108.95
	<u>435,231.06</u>
To Depreciation, General Plant and Equipment..	192,478.85
To Directors' fees	8,800.00
To sundry items written off, including bad debts	5,766.53
To Balance—profit	795,411.15

	<u>\$7,506,098.45</u>
By sales of smelter product, ore, etc.	\$6,349,651.11
By smelter product on hand and in transit from smelter to refineries at Sept. 30, 1915.....	179,448.47
By ore and metals on hand and in transit to the smelter at Sept. 30, 1915—	
Value of Metal Contents correct- ed to market quotations—	
Ores on hand	\$525,899.60
Refinery metals on hand	410,942.17
Ore in transit to smelter....	30,023.15
	<u>966,864.92</u>
By rents and sundry revenue	10,133.95
	<u>\$7,506,098.45</u>

General Manager R. H. Stewart, reports in part as follows:

Operations for the year show a net profit of \$795,411.15 after writing off \$192,478.85 for depreciation on plant and equipment, and charging to Profit and Loss Account \$435,231.06 expended during the period in development on our properties.

Increase in plant account for the year, deducting depreciation and sales of plant, amounted to \$142,430.29. Increase in property account, \$42,372.37.

Production of the company's mines and smelter are shown in the following statements. The tonnage smelted at Trail shows an increase over that of the previous fiscal year of 6,025 tons monthly, or 72,293 tons for the year.

Mine Production.

	Year 1914-15, 1894 to date	
	Wt., tons.	Wt., tons.
Centre Star—Ore	180,410	2,386,753
Centre Star—Concentrates		9
Le Roi—Ore	134,758	1,816,995
Le Roi—Concentrates		612
Sullivan—Ore	44,841	264,408
St. Eugene—Ore	169	1,018,492
Number Seven—Ore		7,388
*Molly Gibson—Ore		5,084

*Number One—Ore	5,598	14,851
*Highland—Ore		1,346
*Highland—Concentrates		2,666
*Maestro—Ore		419
Richmond Eureka—Ore		14,661
Lucky Thought—Ore		36
Ottawa—Ore	35	377
Phoenix Amalgamated—Ore		2,493
*Silver King—Ore		(17,238)
*Ben Hur—Ore	6,767	6,767

Note—Production given above includes that of previous owners.

*Since company acquired property only. Previous records not available.

Smelter Production.

	1894 to date.	1914 to 1915.
Tons ore smelted	4,372,886	447,064
Ounces gold produced	1,610,903	148,891
Ounces silver produced	22,247,832	2,230,500
Pounds lead produced	374,091,124	40,177,910
Pounds copper produced	63,196,978	5,306,184
Gross value	73,402,078	

The company's mines in Rossland are in about the same position as regards ore reserves as at this time last year. The Le Roi mine has increased its reserves to some extent, while the War Eagle and Centre Star mines show a slight decrease in ore reserves.

In the War Eagle the principal development has been the opening up of a new level at a depth of twenty-four hundred feet from the surface, by means of a crosscut from the 16th. or lowest level of the Centre Star shaft, this being connected to a winze from the lowest War Eagle workings three hundred feet above. A small stope has been opened up near the intersection of the winze and crosscut in new ground, but no development has as yet been done in the ground under the stopes on the level above. There have been some new bodies of ore developed in some of the upper levels.

In the Centre Star, on the 6th level, a crosscut has opened up some promising ore in new country, but it has not yet been opened up to any extent. Ore has also been found on the 13th level in ground which has hitherto been unproductive.

In the Le Roi a drift has been run west from the Centre Star shaft and connected with a winze from the lowest level of the Le Roi. and from this drift it is intended to further prospect the ground below the lowest levels of the Le Roi. Considerable productive ground has been opened up in the west end of the mine from the 1,650 level upwards.

At Kimberley, in the Sullivan mine, development has been confined principally to the old tunnel level and the level one hundred feet below it, and some promising bodies of ore have been opened up in the drifts and by diamond drilling. A tunnel has been started at a depth of seven hundred feet below these upper workings, which it is intended will be the main working tunnel of the mine. This tunnel will be between eight thousand and nine thousand feet long before it reaches the present workings of the mine.

Very little work has been done at the St. Eugene mine.

At Ainsworth the mines were closed down during the greater part of the year, a few men being employed at the Highland in driving No. 5 tunnel, which tunnel is



Copper Settlers, Trail Smelter

intended to open up the veins one hundred and ten feet below the lowest previous workings of the mine. Ore has been encountered in this tunnel, but no development has as yet been done on it. The prospects are encouraging.



Roasting Pots, Trail Smelter

In the Number One mine a shaft has been sunk one hundred feet, and a crosscut is now being driven to intersect the vein.

At Slocan City, in the Ottawa mine, only a small amount of work has been done, and some small bodies of high-grade ore have been encountered.

At Silverton a small amount of work was done in the Lucky Thought, but with negative results.

At the Molly Gibson a few men have worked on the tunnel from the surface with fairly satisfactory results, but no ore has been shipped and the mill has not been operated.

No work was done in Sandon at the Richmond-Eureka.

The charge to property account of \$42,372.37 included small amounts for the purchase of claims or rights in Rossland, at the Sullivan and in Slocan City; also development done on properties from which shipments were not made during the year.

Expenditure on plant account for the year is \$334,909.14. Of this amount, \$329,539.64 has been expended at Trail. The principal items of this expenditure have been:—

Purchase of the rights to use the Cottrell patents and the building and extension of Cottrell plants for the lead roasters and furnaces. The saving from the use of these plants is very great already, and will be

greater after some alterations in the electrical equipment.

An additional lead furnace, together with the necessary flues and extension to the furnace building.

An additional crane in the Huntington and Heberlein plant.

Wash houses for men working around the lead plant.

New lead sampling mill, which is not quite finished.

Copper converters and the necessary accompanying plant, also unfinished.

Experimental work on the treatment of zinc.

Rebuilding tanks, and alterations to the lead refinery, also unfinished.

Beds for bedding of copper ores previous to their treatment in the copper furnaces, and some additional electric locomotives and scales used in connection with the bedding plant.

At the Sullivan mine a shovelling machine has been installed for handling the rock from the long tunnel.

During the year considerable experimental work was carried on in the production of electrolytic zinc, and spelter of a good grade has been produced at the rate



Sintering Machine, Trail Smelter

day has been designed and is now being erected. It is hoped that this will be in operation early in the year.

The operation of this plant should make available a very large amount of complex ore at the Sullivan mine, and the extraction of this ore will probably lead to the development of further bodies of lead ore in the same mine.

Notwithstanding difficulties incident to the war, and to the disturbed state of the markets during the early part of the fiscal year, operations have been on the whole satisfactory, and, although the mines in the greater part of the country, which are shippers to the Trail smelter, were closed down for a time, after the commencement of the war, there has been recently a very considerable increase in their activity, and the amount of customs ores received by the smelter has recently increased largely. The total tonnage of customs ore receipts for the year, including lead, copper and dry ores, was 57,251 tons, as against 72,098 tons for the previous year, the decrease being almost entirely due to the decrease in the amount of lead ores received.

There have been a number of changes in the staff of the company during the year, owing, principally, to a number of our engineers having enlisted in the various contingents, which have either gone to the Front or are in training. Those who have gone to the Front are: A. W. Davis, now Lieutenant in the Royal Engineers, who enlisted with the first contingent of Canadian Engineers; K. B. Carruthers, now Captain in the Canadian Artillery, at present at Shorncliffe; A. J. L. Evans, Lieutenant in the Canadian Infantry, now serving in France; A. B. Ritchie, Corporal in the Canadian Artillery, serving in France; Robert Walker, of the Accounting Department, with the Royal Engineers, Divisional Signal Corps, now at the Dardanelles; G. Cruickshank, Lieutenant in the 54th Battalion; H. S. Marlatt, Lance-Corporal, Third Field Company Divisional Engineers; F. A. Fortier, Lieutenant, now in training with Canadian Engineers at Ottawa; R. G. Macfarlane, Assayer, now Lieutenant in the Royal Engineers.

Mr. J. M. Turnbull also resigned from the staff of the company to take the Chair of Mining Engineering in the new British Columbia University.

Besides those named, about one hundred and twenty-five of the employees of the company at the mines and smelter have enlisted in the different contingents, and have either gone to the Front or are in training. In addition to these, some fifty Italians have returned for service in the Italian Army.

The officers of the company now in charge of the various departments of the work are as follows:—

Mr. S. G. Blaylock, Assistant General Manager; T. W. Bingay, Comptroller; James Buchanan, Superintendent of Smelter; H. M. Sullivan, Assistant Superintendent of Smelter; J. F. Miller, Superintendent of Refinery; F. W. Guernsey, in charge of zinc experimental work; C. H. McDougall, Engineer in charge of construction at a Smelter; M. E. Purcell, Superintendent Centre Star Group of Mines; E. G. Montgomery, Assistant Superintendent; F. S. Peters, Superintendent Le Roi Mine; J. K. Cram, St. Eugene and Sullivan Mines; W. M. Archibald, Mining Engineer in charge of Ainsworth and Sloean properties.

OUR RETURNED SOLDIERS

The establishment of the Soldiers' Aid Commission for Ontario, of which the secretary is Mr. C. N. Cochran, Parliament Buildings, Toronto, is the first result of the report recently issued by the Hospitals Commission, and the forerunner of others.

The care of the soldier who has returned to Canada, mutilated or weakened as a result of active service, is the prime duty of Canadians. For some months the Canadian Patriotic Fund has been endeavoring to ensure that the men already back from Europe should suffer no want. This work has been voluntarily undertaken by local committees of the fund, although in most instances their time is fully occupied with the task of making provision for the families of soldiers.

Each soldier is interviewed at Quebec by a representative of the fund and a confidential report sent by the latter to the patriotic committee of the town to which the soldier is going. This serves the two-fold purpose of protecting the fund against the greedy or unscrupulous and of giving the local committee information that is helpful in finding employment for the deserving. Not every man who returns to Canada wearing His Majesty's uniform is included in the latter category, but the great majority have done their duty in the fullest degree. To the latter it has been the privilege of the fund to present a small badge bearing the words "For service at the Front." The men who are wearing these badges are the worthiest citizens that we can acknowledge. Like charity, that badge should be allowed to cover a multitude of sins.

The work that the Canadian Patriotic Fund can do for returned soldiers, however, is limited by Act of Parliament, and it has been specifically enacted that no assistance can be given by the fund to "any person who is in receipt of any gratuity, pension or allowance paid by His Majesty or by any foreign government in consequence of incapacity or death occurring as aforesaid." Partly on this account and largely because the pensions and gratuities paid to incapacitated men are oft-times admittedly inadequate, it has been necessary to establish a Hospitals Commission and Disablement Fund. The officials of the latter, in their report to the Federal Government, recommended among other measures, that provincial commissions be formed for the purpose of supplementing these pensions either by monetary grants or by free training in various trades. The Soldiers' Aid Commission of Ontario, as we have said above, is the first step in this direction. Already it has announced its intention of mobilizing the manufacturers of Ontario and we do not doubt that the process will be facilitated by the manufacturers themselves. Others also will be asked to lend their aid in discharging a great national duty and there is every prospect that in Canada at least the traditional tragedy of the returned soldier will have no place.

Mining in Boundary district is largely restricted this winter to operations at the copper mines of the Granby Consolidated Co. at Phoenix and of the British Columbia Copper Co. near Greenwood. Leasers are working at the Jewel gold mine, and at the Skylark silver mine, both in Greenwood mining division. Further prospecting is being done in Franklin camp, up the north fork of Kettle river, and several small mines in the neighborhood of Beaverville, west fork of Kettle river, have been sending out carload lots of high-grade ore.

RELATION OF GOVERNMENTS TO MINING*

By Horace V. Winchell.

Full consideration of this subject would involve its elaboration to an extent far beyond the limits permitted to this paper, and be largely repetitive of much that has often been ably presented by economists and philosophers of this and other lands. Indeed, its fundamental importance may perhaps have been more clearly apparent in the days before our industrial systems and operations reached their present state of complexity, and may to-day sometimes be lost sight of in the maze of legislative enactments and the multiplicity of modern industries, which, although impossible without the aid of mining and its products, yet have attained proportions of such dimensions as to endow them with attributes of apparent primary rank.

Nearly half a century ago there was presented to Congress and the people of the United States a discussion of this very subject by Dr. R. W. Raymond, who has been long recognized as the dean of American mining engineers. The arguments there advanced are of universal application; and no later author is likely to improve on the manner of their arrangement and presentation. To this article the present writer wishes first to pay his respects; and from it to appropriate language, ideas and references.

It has been said that "mining and agriculture are the two great forms of productive industry. Strictly speaking, agriculture is the most important, since without it men could not exist; yet mining is almost as essential, since without it men could only exist as savages." If this be true, then the man who makes two blades of grass grow where one grew before is no more desirable and valuable a citizen than he who adds tuppence to the world's supply of available and useful minerals. The prospector and the miner are as useful and as necessary to general prosperity as is the farmer; and the fostering arm of government should be extended with equal care over both. Indeed there are considerations which justify closer attention of lawmakers and greater liberality of appropriations for the encouragement and protection of mining than for farming. On this point Dr. Raymond speaks as follows:

"1. The products of mining are in general far less perishable than those of agriculture, and, in proportion to their first cost, of greater, because more prolonged, use to mankind. Who can estimate the blessings diffused by a ton of iron, mined, smelted, wrought into forms of beauty and usefulness, serving for generations the needs of men, and repeatedly reformed, and reappearing, as by a material metempsychosis, to enter upon new periods of beneficence? More difficult still is it to measure the importance of gold and silver, the production of which, aside from their application in the arts, is so subtly connected with the profoundest problems of political economy. The sophistry that gold and silver money is a conventional matter altogether is trivial. So is all society conventional; and the things upon which mankind have agreed are the things which God has ordained. Gold and silver are world's money, or means of exchange; and this accepted medium must bear a certain relation to the volume of the world's business. Experience, speaking

louder than the philosophers, has shown that, in spite of all contrivances of barter, credit, and paper money, the supply of the precious metals is of vital importance to all commercial nations.

"2. Gold and silver are especially valuable as articles of export. If a country produces more grain than it can consume, it must seek a market elsewhere for its surplus, and this market may not be readily found. Besides, there is danger of loss or deterioration by transport and storage. The precious metals, on the other hand, command the markets of the world. They can be shipped or hoarded without deterioration, and they form the best basis of international exchange.

"3. But these advantages of mining are counterbalanced by the fact that its sources are not perpetual. Men till the same soil for generations, and, if it is properly cared for, it is as able at the end as it was at the beginning to sustain the desired crops. But every mineral deposit is certain, sooner or later, to be exhausted. Sometimes this exhaustion is absolute. The valuable mineral is all extracted, and the end of the deposit is reached. This was the case a few years ago with the silver mines of Andreasberg, in the Hartz Mountains. Sometimes the exhaustion is merely an economical one. The deposits continue, but it no longer pays to work them. This is the disaster looked forward to within the next century by English economists with regard to the coal mines of England. In either case the source of wealth is closed, and great national changes are often the result. We may say, then, that mining yields a permanent form of wealth from a transient source, while agriculture presents a perennial source of perishable wealth.

"4. The mistakes of mining are always to a greater or less extent irretrievable. Wasteful and ignorant farmers may exhaust the soil; but nature, time, and skill will restore it. Even the wanton destruction of timber entails upon a nation only a temporary evil, since the trees will grow again. But the economic exhaustion of a mine, or a whole mineral region, can be brought about by reckless mining beyond the possibility of restoration. * * *

"5. Finally, the resources of mining are not so equally distributed among nations as those of agriculture, and, as a consequence, the relative power of nations depends largely upon their mines. The iron and coal mines of England are well known to be the secret of her commercial strength; and in the United States the State of California owes her wonderful progress and increasing power to the mines. Even the enormous agricultural capacity of that State (however much her farmers may sneer at the idea) would never have been known nor developed but for the gold mines.

"In view of these peculiar relations of mining, it is evident that governments are in a certain sense trustees of the wealth stored in the mineral deposits of their realms—trustees for succeeding generations of their own citizens and for the world at large. It is not a matter of indifference to the citizens of this country whether our mining fields be ravaged and ex-

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.

hausted in one or even five centuries, when they might last a score."

Since the power and relative standing of nations wax and wane with their control of necessary minerals, it has been commonly observed by historians that many of the wars of history have been occasioned by a desire on the part of one country or people to possess mines situated in the territory of another. Thus it has been pointed out by Hoover that Jason and the Argonauts in their search for the golden fleece were nothing but placer miners, the gold that they sought being in the sands of eastern rivers; the mines of Laurium often furnished the sinews of war for the Greeks; the contest for supremacy between the Romans and the Carthaginians was founded upon the desire of the Romans to acquire the mining interests of the people of Carthage. After the Romans gained possession of the mines of Rio Tinto they made war in Gaul to capture slaves for working the mines. In more recent times, we recall the conquest by the Spaniards of Peru and Mexico in the search for golden treasures, the struggle between the Swedes and other people of northern Europe over the sovereignty of the great Fahlun copper mine, which was called by Gustavus Adolphus the "Treasure House of Sweden"; the conquest by the Germans of the iron ore and coal fields of Lorraine; the struggle in the Boer war over the control of the Transvaal gold mines, the conquest by the French of Tunis and Algeria, with their rich deposits of iron ore and phosphates; and the still more recent invasion and capture of the principal zinc producing districts of Belgium.

Indeed, from the very earliest days, dominion over minerals has been a prime desideratum of man. Our stone age ancestor quarried the rock from which to shape his weapons; tribal communities located their habitations near the deposits suitable for such purpose; and many an unrecorded contest was fought to a sanguinary conclusion between those in possession and those who came from afar to renew their stock of arrow points, red pipestone for pipes, and native copper for domestic utensils or spear tips. Miners operated before Tubal Cain had use for a forge or Solomon and Croesus could accumulate their treasures. The geographical distribution of the human race has from the very earliest times depended on that of easily won mineral deposits, and relative stability and tribal or national supremacy has been conditioned by the ability to retain and use them most extensively. "The discovery and appropriation of minerals, thus, long preceded the settled rights or even the early pretensions of the crown or overlord. Held by the mere fact of possession in the days when might was right, the fundamental ownership and title to minerals gradually became merged in the landlord and the discoverer with varying extent of proprietorship as laws became established."

And to-day we find a more or less complicated system of jurisprudence governing the appropriation and use of minerals in different countries. Recognizing the prime importance to every nation that its mines be worked, and, at the same time, taking cognizance of the fact that mining is an occupation financially hazardous, as it affects the proprietor, and individually perilous for the miner, in these days when slaves are no longer used and the laborer is admittedly worthy of his hire, all countries provide by statute those regulations which are considered best suited to local conditions and most likely to encourage the industry.

Two fundamental principles are common to the mining law of all countries: (1) The right of the mineholder to a perfectly secure and indefeasible title to his property so long as he fulfills certain specified conditions entirely within his own control; and (2) the right of the state or other landlord to certain rents, royalties or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines, the result may be a rapid decline of the mining business and a shifting of the population to more favored communities.

In these days, when our production and consumption of minerals has mounted to towering figures, it has been strongly urged by some that we are prodigal in their expenditure and that the principles of conservation dictate restrictive measures, to the end that there may be something left for future generations. Much alarm has been occasioned in the minds of a certain element of our population by the widely disseminated predictions that our mineral resources are becoming exhausted. The National Conservation Commissions and similar organizations, of this and other countries, have endeavored to form estimates of the supplies of useful minerals known or reasonably supposed to exist within their respective territories; and attempts have even been made to measure the total tonnage of iron ore and coal remaining in the ground in all the lands of the globe.

The results of those mineral censuses have tended to allay the alarm. It has been discovered that although our supplies of coal will not last very long at the constantly increasing rate of consumption which has been maintained for the past half century of tremendous industrial development, yet there is enough in the United States to last us for more than 6,000 years at the present rate, and coal fields of unknown size exist in many other little explored lands.

The blast furnaces of the world seem to possess an appetite that is insatiable, and their size keeps pace with their growing consumption of iron ore. Yet, vastly more ore of commercial grade is being discovered than consumed, and the price, although unstable, tends downward rather than upward. Improvements in the art of recovering metals from various ores are constantly increasing the supply of usable raw materials, and he must be indeed a pessimist who can predict the exhaustion and disappearance of any mineral indispensable to the welfare of the human race.

But even though we may take for granted the sufficiency of the world's stores of minerals, the fact of their unequal distribution often gives to one country an advantage over another; and the less favored countries must do their utmost by protective and encouraging legislation to equalize matters, making their abundance in some resources compensate for poverty in others. Herein, and in true appreciation of the importance of mining and industrial economy, lies the opportunity for constructive legislation.

(To be continued.)

THE DEVELOPMENT OF ELECTROLYTIC COPPER REFINING*

By Lawrence Addicks.

The rapid progress of electrolytic copper refining in the past twenty-five years has been due to several causes. While the possibilities of the electrolytic separation of metals had been understood in a general way, there was no suitable source of current until the dynamo was practically developed in the seventies. This, at the same time, made possible the development of the whole family of modern electrical industries and thereby created the demand for high conductivity copper, which can only be obtained from very restricted pure ores or by electrolysis.

If we say that electrolytic refining costs $\frac{1}{2}$ cent a pound over fire refining and that copper sells for 15 cents a pound, it will take but a 3 1-3 per cent. gain in conductivity to pay for the refining, when electrical uses are involved. Further, it is quite impossible to make a clean separation of silver and gold from copper by fire methods, while the "values" in cathode copper run but a few cents a ton. Copper is nearly always associated with silver and gold and our $\frac{1}{2}$ cent a pound increase in cost calls for but \$10 a ton of either or both of these metals to justify electrolysis from this standpoint.

The first commercial experiments in the United States, in the electrolysis of copper were carried out at Phoenixville, Pa., in 1879, but the tonnage handled was negligible for several years, and we may take, say, 1884 as the starting point for the industry.

The first great difficulty was in keeping the purity of the electrolyte within reasonable bounds; the early electrolytic copper was very irregular in quality, resulting in a market premium for "Lake" copper produced from the pure native ores of Michigan. About this time bessemerizing of copper was accomplished, resulting in a high elimination of impurities from matte, owing to the strong oxidizing of the converter, and the universal adoption of this process removed the last obstacle to the expansion of electrolytic refining.

How rapid this expansion has been is shown in the accompanying table. As a matter of interest, the tonnage refined by the series and by the multiple processes are shown separately, as in the early days there was strong rivalry between the processes.

Both processes have survived and given relatively pure bullion. There is little to choose between them. The multiple process, however, is much less sensitive to impurities and requires less skill in operation, and has been adopted by those later entering the refining business.

Pounds per Year Electrolytically Refined.

Year.	Series.	Multiple.	Total.
1884	0	0	0
1890	.....	.....	.....
1896	102,000,000	150,000,000	252,000,000
1902	146,000,000	412,000,000	558,000,000
1908	430,000,000	734,000,000	1,164,000,000
1914	642,000,000	936,000,000	1,578,000,000

Three distinct stages in the development of copper refining may be noted; that of early development; that of tonnage extension; and that of efficiency work. The first period ends with the development of mechanical ladling, general use of cranes for handling electrodes and the undertaking of the building of the Raritan Copper Works in 1898. The second period covers the next half-dozen years, which saw the creation of the first really large plants; and the third, ten years just closed, with plenty of work in sight to put refining on a finished basis.

Refining proper may be considered to begin with the treatment of copper bullion of the grade of converter blister and may be divided into anode furnaces, electrolysis—including production of power, electrolyzing, purification of electrolyte, and refining of anode slimes—and refining furnaces for the cathode product.

The anode and cathode furnaces have so many points in common that they may be considered together, taking the latter as the example. The size of charge taken out in the 24-hour cycle has steadily increased with the capacity of the plant, until it has become evident that the only practical limit is the tonnage a plant can supply. Before mechanical ladling was introduced, the size was limited to the amount that could be taken out by hand. Even when a bull ladle was used, 40,000 lb. was considered a large charge. As soon as the Walker Wheel and other machines for mechanical ladling were successfully introduced, the size of charge was increased to 100,000 lbs., with marked lowering in all items of cost; and since then there has been a regular speeding up in each of the time-consuming elements making up the 24 hours, until with the modern charge of 600,000 lbs., or more, the refining is done for less than half the cost in the best of the old hand-ladled furnaces.

Furnace refining may be divided into charging, melting, rabbling, skimming, coking, poling, ladling and fettling. Charging is now done mechanically, by special cranes, at the rate of 300,000 lbs. an hour. Melting has been accelerated by means of forced and induced draft, the modern method being a combination of both in connection with waste-heat boilers. Mechanical stoking has been tried several times, as well as the use of fuel oil and pulverized coal. Up to this writing, however, hand-firing, combined with what is practically a gas-producer fire-box, has held its own. The coal consumption has fallen, with the increasing size of charge, from about 20 per cent. at 40,000 lbs. to 10 per cent. at 600,000 lbs. The fuel item is much smaller than in the case of either reverberatory matte smelting or open-hearth steel practice. Rabbling by hand has given place to blowing with compressed air. This, in turn, has raised structural questions in the design of the furnace on account of the consequent damage to the roof from the splashing of more or less oxidized copper. In anode practice this is now being met by the use of basic or neutral brick in the roof, and when melting cathodes, the blowing has been greatly curtailed. Skimming is still done by rabbles, but the proportion of slag made has been gradually reduced from 4

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per cent. to less than 1 per cent. by keeping silica from the furnace lining, or from coal ashes, away from the cuprous oxide formed while melting and blowing. Coking used to consist in blanketing the bath with charcoal, but crushed low-sulphur coke or anthracite has been largely substituted. Poling is still done with green hard-wood poles forced under the surface of the bath. Fuel oil has been tried, but it is difficult to avoid overpoling, on account of the rapidity of the action, and the sulphur content spoils the set of wirebar copper.

Some hydrocarbon gas may be substituted in time. Ladling is now done mechanically at as high a rate as 90,000 lbs. an hour with one ladle and 120,000 lbs. an hour with twin ladles. This speed could easily be increased by tapping the furnace at two places. Fettling is practically eliminated with basic furnaces.

It is now realized that the only obstacle to changing the furnace refining of cathode copper into a simple melting is sulphur brought over as sulphates from the tank-house or absorbed from the products of combustion, etc., in the furnace. With a perfect cathode and a sulphur-free atmosphere, the process could be made a continuous melting, and steady progress is now being made toward this goal. The great capacity of modern furnaces is due partly to increased hearth area, but quite as much to deeper baths and the constant feeding in of fresh cathodes (or anode scrap) during poling and pouring. In some plants blowing has been practically eliminated, and the production of slag almost suppressed in the cathode furnaces.

Structurally, the main improvements in recent years have been along the line of substitution of magnesite and chrome brick for siliceous material. Magnesite hearths are now thoroughly proved out for treating foul pig. Magnesite flash-walls, for all classes of work, are now yielding place to solid chrome walls, and chrome brick is contesting with silica brick in roof construction.

Power.—Turning now to the electrolytic part of the plant, we may dismiss the power problem very briefly as not being truly metallurgical in its nature. The characteristics of the power requirements are high amperage, low voltage direct current, with a 100 per cent. load factor. As individual circuits are limited to about 1,500 kw., the reciprocating steam engine is at its best under these conditions, and up-to-date a high-economy, slow-speed, compound or triple-expansion engine, generating a kilowatt-hour for about 15 lbs. of steam at 150 lbs. pressure sq. in., 100 degree F. superheat, and 27-inch vacuum, has been favored. The plants around New York harbor are able to procure steam sizes of anthracite at a much lower price than coal suitable for gas-producer work. Considerable steam is also produced by the waste-heat boilers on the reverberatories. Gas engines have therefore been handicapped and have not as yet found a single application. The total capacity of the power plant has been a little too small, in extensions to existing plants, to justify the consideration of a central turbo-alternator of the great capacity necessary to develop a sufficiently low economy to offset the conversion losses in motor generators, and large high-speed direct-current turbo-generators are still in their infancy. We may therefore say that reciprocating engines still hold the field but that the indications are that the time is coming when they will have to surrender to a prime mover which can operate through a wider temperature range.

In the tank-house, capacity has been pushed from all sides. The Walker system of connections, whereby many tanks are placed edge to edge with but a small equalizing bar for carrying the current from the cathodes of one tank to the anodes of its neighbor, has been universally adopted, resulting in an increased efficiency in the use of floor space as well as cutting down the bus-bar investment. The size of the anode has been steadily increased, until several plants use electrodes three feet square, and in at least one leaching plant, four feet square. The number of anodes per tank has also been increased. Thirty-two have been successfully placed in space originally planned for twenty-six, and longer tanks can easily be used, the limit really being the amperage on the circuit. Current densities have gradually risen with the lower costs of power, until Eastern practice is close to 20 amperes per square foot. A current efficiency of about 90 per cent. seems to express the economical balance between labor and power. Lead-lined wooden tanks are still universally used in multiple-system practice, but their maintenance is a large item and much experimenting is now under way with various types of tank construction. The ideal system would be a large acid-proof basin without watertight division into single cells, the electrodes being supported independently by an independent bridge structure. Chemically, it is generally realized that a highly refined anode is more important than a pure electrolyte, and with anode copper 99 per cent. or over, an electrolyte with 2.5 to 3.0 per cent. copper and 12 per cent. free sulphuric acid will give good results with almost any quantity of arsenic, nickel, etc. A good quality of anode has diminished the silver and gold losses in the cathodes until they are now but a small item—perhaps half of one per cent. of the anode contents at ordinary current densities. Basic anode-furnaces have made possible the production of a first-class anode from very foul raw material.

The general improvement in the grade of anode has simplified the problem of purification of electrolyte. The complete plant now used is to divert the necessary portion of electrolyte daily, remove the copper and arsenic as a cathode sludge, using insoluble anodes, concentrate the resulting liquor, first by steam in lead-lined tanks and then by direct heat in iron vessels, to a heavy liquor consisting of strong sulphuric acid and sodium sulphate, the sulphates of iron, nickel, etc., having fallen out as anhydrous salts. The sodium sulphate can be largely removed by chilling, if it is present in troublesome quantity, and the sulphuric acid returned to the electrolyte. The anhydrous salts form a starting point for nickel recovery. A small quantity of either hydro-chloric acid or salt is added to the electrolyte, with the result that the antimony largely slimes as oxychloride. Glue or similar organic addition agents are generally used in very small quantity and greatly assist in forming smooth cathodes, although a slight excess greatly increases the working voltage. In general, six to seven pounds of cathode copper are obtained per kilowatt-hour.

The refining of the anode slimes is still in a transitional stage. A great deal of experimental work is being done on wet processes, on account of the metal losses associated with fire methods. As anode slimes are worth five to ten dollars a pound and a large refinery produces a couple of tons of such slimes daily, a considerable expenditure on treatment is permissible. A simple fusion of raw slimes will yield three superimposed molten layers,—bullion, matte and slag. The

bullion is chiefly made up of the precious metals, lead and copper; the matte of copper, silver, selenium and tellurium; and the slag of the more easily oxidized elements, such as arsenic and antimony. The general plan in common use is to give the slimes a light roast to oxidize the copper, which is then dissolved as sulphate in suitable tanks. The copper-free slimes form but little matte when smelted. After fusion in a small basic reverberatory the bath is skimmed clean and the base bullion refined to a high grade, done by blowing and nitreing. The slag is sorted, part sent back to the anode furnaces, part desilverized by a quiet fusion to free it from prills and part charged back into the silver furnace. The silver and gold are generally parted electrolytically and the resulting gold slimes treated for recovery of platinum and palladium. Selenium is recovered from the silver refinery flue dusts by leaching and reduction with sulphur dioxide.

One of the great difficulties in the way of devising a comprehensive wet process lies in the great variation in composition of the slimes at different times and places and in the number of elements present. The strong solvent action of ferric sulphate upon copper and the purity of silver chloride precipitated from foul solutions give a foundation for a wet process. The progress in electrostatic fume recovery is helping out the older process, however.

UNITED STATES IRON TRADE IS BRISK.

Under date of December 23 "The Iron Trade Review" says: With prices continuing to advance on pig iron and finished materials, consumers are still clamoring to place additional orders and the announcement that there is nothing to sell is being made by more mills and furnaces.

The congestion on the railroads between Pittsburgh and tidewater is becoming a serious factor in the pig iron market and threatens to be much worse unless the railroads succeed in adopting some radical measures of relief. The pig iron market throughout the country is very strong and prices are steadily being moved upward. Along the lakes, from Chicago to Buffalo, quotations are higher and available iron is being rapidly reduced. The Norfolk & Western railroad is distributing orders of an inquiry for 10,000 tons of various grades for last half delivery, but not many sales for delivery after July 1 are reported. Furnaces, especially those along the lakes and in the valleys, are unwilling to quote for deliveries so far in advance.

Scarcity of billets and sheet bars continues and many consumers are worrying as to where and at what price they will be able to buy for early requirements. In eastern Pennsylvania forging billets are selling at \$55 and open hearth and rolling billets at \$40. Very high prices prevail in Pittsburgh.

Inquiries, amounting to several hundred thousand tons of steel bars, largely rounds for the manufacture of high explosive shells, are pending. It is estimated that the entente governments will require at least 500,000 tons of various forms of steel, principally bars, for shipment before July 1, and fully as great a tonnage for the last half of the year. It is difficult to obtain delivery on any tonnages of large size for the first half on account of the mills being overwhelmed with orders. Shipments of sheet steel to Europe at present are estimated at 10,000 to 15,000 tons weekly and much of this is for shrapnel.

The recent order of the English government in regard to the importing of machine tools into the United Kingdom does not promise to interfere with the movement of machinery to England, except that speculators who have obtained exorbitant prices will not be allowed to continue to do so. Heavy buying by Russia continues to be a leading feature of the machinery market. The freight congestion is causing considerable annoyance to manufacturers.

Extraordinary demand for blue annealed sheets has brought about a decided scarcity and leading makers are entirely out of the market, while others are quoting very high prices. Owing to the high quotations on spelter, galvanizing operations at many sheet plants have been abandoned. Prices of black sheets have been advanced. Prices of wire products, with the exception of galvanized wire nails have been advanced \$2 a ton to a basis of \$2.10 a keg for wire nails, the highest price since 1901. Wire products are now quoted at from \$12 to \$13 a ton above prices of a year ago, but sales at the new quotations are limited, as nearly all consumers are under contract. Advances have been made in cast iron pipe and higher prices on steel pipe are expected. Coke is gradually growing stronger, thus eliminating the only weak feature of the present market. Sharp advances are noted in scrap in several centers and the demand is active throughout the country. The very high price of old material has caused some manufacturers of bar iron to withdraw temporarily from the market, as they have taken all the orders for iron that they desire and are awaiting developments in the scrap market. This is true in the Cleveland district.

TIN MINING IN ALASKA.

It is estimated that about 200 tons of stream tin were produced in Alaska during 1915. Much the larger part of the tin came from the York district of Seward peninsula. Here one tin dredge was operated throughout the season on Buck Creek. A new dredge was installed on the same creek during the summer and operated for a part of the season. No returns have yet been received from the two dredges operated in 1914 on Anikovich river in the same district, but these were probably also operated. These two are working on placers carrying both tin and gold. Developments were continued on the Lost river lode-tin mine, and there was also some prospecting of other lode-tin deposits. There was, however, no production of lode tin.

The only other tin mining in Alaska during 1915 was done in the Hot Springs district of the lower Tanana basin. Here considerable tin is recovered incidental to gold placer mining.

At the quarterly meeting of the Slocan District Board of Trade, held at Silvertown, Slocan Lake, B.C., on December 9th, Mr. J. P. Keane, of Rosebery, submitted some interesting data relative to the zinc industry of Canada and having particular reference to the production of spelter in the Dominion. After discussion it was unanimously resolved, on the motion of Mr. W. H. North, local manager for the Standard Silver-Lead Mining Co., operating a silver-lead-zinc mine and concentrating mill near Silvertown, to memorialize the Dominion Parliament to place a protective duty on imports of zinc and zinc products to become effective as soon as spelter shall be produced on a commercial scale in Canada. There were present at the meeting delegates from Silvertown, New Denver, Rosebery and Sandon.

MINING IN ALASKA IN 1915

The annual report on mineral resources and production in Alaska for 1915 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey. Some of the important features of this report relating to mining development during the year are abstracted in the following statement.

The Alaska mining industry as a whole was more prosperous in 1915 than in any previous year. This is indicated by the value of the total mineral output, which is estimated to have been \$32,000,000, compared with \$19,064,963 for 1914. The highest value for any previous year was in 1906, when Alaska produced \$23,378,428 worth of minerals, but this was at a time when the bonanza placers of Fairbanks and Nome were yielding their greatest returns.

The high value of the mineral output in 1915 was due in large measure to the extraordinary amount of copper that was mined. Preliminary estimates indicate this to be 83,850,000 pounds, valued at \$14,400,000. In 1914 21,450,628 pounds of copper were mined, valued at \$2,852,934. The gold production also increased in 1915, when the value was about \$16,900,000, against \$15,626,813 for the output of 1914. This is the largest gold production since 1912, when the output was valued at \$17,145,951. As the production of silver is incidental to gold and copper mining, this also increased. It is estimated that \$400,000 worth of silver was mined in 1915, against \$218,327 worth in 1914.

The output of other minerals, including tin, antimony, marble, gypsum, coal and petroleum, in 1915 had a value of about \$300,000, compared with \$222,802 in 1914.

In addition to the productive mining a large amount of dead work was accomplished during 1915 on properties that made no output. Therefore the abnormally large value of the total mineral production must not be considered as simply a temporary expansion of the mining industry, due to the high price of copper. The developments made during the year give assurance of continued large operations in both copper and gold lode mining. Placer mining has been less prosperous, for this industry has not yet reacted to the stimulus of the Government railway, which will make available for profitable exploitation large bodies of low grade gravels. The same is true of the coal mining industry, which also must await railway transportation.

The first gold mining in Alaska was done in 1880, and since that time gold to the value of about \$261,050,000 has been produced. Of this about \$186,200,000 has been won from the gold placers. Copper mining began in 1901, and the total copper output of Alaska is now about 217,250,000 pounds, valued at \$34,150,000. The value of the total silver production to date is about \$2,650,000. Coal, petroleum, tin, lead, quicksilver, antimony, marble, gypsum and other minerals have been produced to the value of about \$2,150,000. Therefore, the value of the total mineral production during 36 years of mining in Alaska has been \$300,000,000.

The data in hand indicate that the value of placer gold produced in 1915 was \$10,500,000, compared with \$10,730,000 in 1914. This decrease of output, if borne out by the final figures, is chargeable to the falling off in the output of some of the Yukon camps. On the other hand, the developments in the Tolovana district, where gold was discovered in the autumn of 1914, indicate that this will become of some importance as a producer.

MINING IN HIGHLAND VALLEY, B.C.

The Highland Valley Mining and Development Co. has been organized by Messrs. Frederic Keffer and Henry Johns, both of whom were for a number of years prominently connected with the management and operation of the British Columbia Copper Co.'s mines in Boundary district, B.C. The first work to be undertaken by this company is the development and operation of two groups of mineral claims held under bond by the company, and situated in Highland valley, Ashcroft mining division of British Columbia. These groups are known, respectively, as the Chataway and the Sanson (or Tamarac) groups of claims. They are reached by a good wagon road from Ashcroft, 25 miles to Chataway ranch and thence by trail between three and four miles to the mine workings. The elevation of the workings is about 4,400 feet above the Canadian Pacific railway at Ashcroft and 5,400 feet above sea-level. The locality is in what is known as the "dry belt" of British Columbia, where both snow and rainfall are comparatively light.

Chataway Group.

There are four claims in the Chataway group. The country rock is a coarse-grained granite with the feldspars predominating. The ore follows lines of fracturing in the granite and is composed of quartz, feldspar, mica, and copper and iron pyrites, the mica being the most plentiful mineral. The copper occurs entirely as copper pyrites, and as a rule is distributed through the gangue in quite large crystalline masses, thus forming an ideal ore for concentrating, especially as the gangue is soft and easily broken. The ore is usually quite free from the walls of the vein.

Development work done consists of an adit driven with the ore for about 80 ft.; then in barren ground for 95 ft., the ore having been thrown a short distance to the north by a fault and then for another 80 ft. with the ore. Near the adit entrance a winze has been sunk 50 ft. in ore. Where explored the vein varies in width between 4 ft. 6 in. and 14 ft.; the average width is approximately 10 ft. Average assays of the ore are stated to give 5 per cent. copper, and gold and silver together 60 cents to the ton.

The first new development planned is to drive a second adit along the vein at approximately 100 ft. below the adit already driven. Subsequent development will be determined by results obtained in driving this lower adit.

Sanson Group.

The Sanson group of seven claims adjoins on the east the Chataway group of which it is regarded as an extension, the country rock and vein filling being identical with those of the Chataway and the conditions generally similar. There are three open cuts on the copper ore showing along a distance of 244 ft. The average metal contents of the surface ore are given as 2.80 per cent. copper and about \$1 a ton in gold and silver.

The ore occurrences on the two groups of claims are more than one mile apart, but as yet no connection has been traced between them, the deep cover of soil rendering prospecting somewhat difficult.

Farther east on this group there are a shaft and some cuts on what is termed the molybdenite vein, but this is not considered to be of much present interest. Promising croppings of copper ore have been found on another of the claims of this group.

BRITISH COLUMBIA'S NEW MINISTER OF MINES

The resignation on December 15th of Sir Richard McBride as Premier and Minister of Mines for British Columbia has led to the appointment of a separate minister to the important folio of the Mines Department of that province, and the choice has fallen on a man of Ontario birth, and, withal, one who, of all the members of the Provincial Legislature of British Columbia, has been most intimately associated with the mining industry. Not only has Mr. Lorne A. Campbell had long familiarity with the affairs of metalliferous mining companies, but as well he has been in the capacity of president of the McGillivray Creek Coal and Coke Co., Ltd., operating in Southwestern Alberta, closely identified with coal mining. The following information concerning Mr. Campbell was published in the Victoria Daily Colonist, the oldest and one of the most influential of the daily newspapers of British Columbia:

Hon. Lorne Argyle Campbell, the new Minister of Mines, who represents Rossland, was born on March 5th, 1871, at Perth, Ontario. He is the son of John G. Campbell, and his wife, Helen I. Campbell, both Canadians. He was educated at Perth public school and collegiate institute. He is vice-president and general manager of the West Kootenay Power and Light Co., and president of the Cascade Water Power and Light Co., etc. He first contested Rossland seat in 1907, but was not successful until the general election of 1912, when he swamped his opponent. Mr. Campbell's nomination at this election was supported by Conservatives, Liberals and Socialists alike. Naturally, he is extremely popular in his constituency, where his able and energetic personality and his persistent and aggressive advocacy of the claims of his district have given him a position of unique popularity. He is well known as one of the foremost business men of the provincial interior, who has played a very useful and important part in the upbuilding of the mining and general industrial interests of the Kootenays. His majority at the last election was a record for the constituency.

In assuming the portfolio of Minister of Mines, the Hon. Lorne Campbell will bring to the execution of his duties a mind especially well fitted for the task, for ever since he took up residence in British Columbia, he has been living in the heart of a mining country, and probably knows as much about the industry as any man in public life in the country to-day. His position as head of the West Kootenay Power & Light Co., with which he has been identified since its inception, brought him into intimate relation with the mining industry in the Kootenay and Boundary districts, from the circumstance that this project was founded chiefly with the idea of supplying power and light to the numerous mining properties and the smelting works in those districts. It is well known that Mr. Campbell holds some advanced and progressive ideas in respect to what ought to be the policy of the Government in fostering the mining industry; and his tenure of the important portfolio which has been allotted to him will, it is assured, be characterized by an intelligent aggressiveness founded upon an intimate knowledge of what is required to place the industry in the new position rendered imperative by the world-shaking events which have transpired since the outbreak of the war.

THE ALUMINUM CO. OF AMERICA.

Boston.—President Davis, of the Aluminum Co. of America, recently made a speech at Detroit to a gathering of men interested in aluminum, which was notable as indicating the efforts his company is making to increase the production of aluminum.

Mr. Davis stated that his company was now producing 18 pounds of aluminum where 10 pounds were made in 1914. This would indicate an output of 144,000 pounds per annum.

The company is now expending upwards of \$20,000,000 to increase its production. Some portions of the new plants will be in operation next May, and the balance by the close of 1916.

This expenditure does not include the extensive plant of the Southern Aluminum Co. which the American Co. has recently taken over, but which will not be in operation for another 12 months.

Referring to the current high price of aluminum, Pres. Davis said that it was in part due to the fact that the British Government had commandeered the production of his company's plant located in Canada for the current year and 1916, so that this supply, 8,000 or 10,000 tons per annum, goes to England instead of coming to the United States as usual.

As to war orders, Mr. Davis stated that his company had not sold an ounce of aluminum for any war order, directly or indirectly.

In the manufacture of the white metal, cheap power is the sine qua non. The Aluminum Co. of America started in to develop a big water power on the St. Lawrence river, expecting to create some 800,000 horse power. Several million dollars have already been invested in it, "but until this deadlock is broken between these people who are conserving the interest of the public, and those who are willing to give the corporations a little chance, I do not suppose that water power can ever be developed." All this results in confining the efforts of the company to small streams, and at increased cost.

The Aluminum Co. for several years has enjoyed a profitable return upon its capital. Its dividends have been limited, however, with the result that it has abundant resources to carry out the extensive plans it has in contemplation.

SILVER.

The production of silver in the United States in 1914, the largest ever recorded, was 72,400,000 ounces, valued at \$40,000,000. The silver production of the world is estimated as about 225,000,000 fine oz., of which the Cobalt district, Ontario, produces one-tenth and the United States produces one-third. Practically three-fourths of the world's silver production is derived from North America, about 14 per cent. from Europe, and the remainder mainly from Australia and Asia.

STELLITE.

The Haynes Stellite Co., of Kokomo, Ind., has placed a contract with the Snyder Electric Furnace Co., Chicago, for a 1½-ton per 24-hour electric melting furnace. The furnace has an eighth ton holding capacity, 50 k.w. input and will produce 12 heats per 24 hours. The Haynes Stellite Co. is the manufacturer of the cobalt alloy stellite, which has been making a number of remarkable records during the past two or three years. Mr. Elwood Haynes, president of the company, will be remembered as the manufacturer of the first American automobile, and it is planned to hold a great anniversary celebration in his honor next year at Kokomo.

EVALUATING COAL PROPERTIES IN WESTERN CANADA

By R. W. Coulthard.

The most recent estimate of the content of the Western coal beds of Canada is 1,217,386,000 tons, which is classified as follows:—

Anthracite and Semi-Anthracite, 830,000,000 tons; Bituminous, 282,313,000,000 tons; Sub-Bituminous, 847,821,000,000 tons; Lignite, 86,422,000,000 tons.

So enormous, therefore, are the fuel potentialities, that we must content ourselves with the consideration of such of these as are a present economic asset. And this it is the function of the engineer to ascertain.

Some of the essentials which will determine the value of coal properties I shall enumerate. These essentials have reference, primarily, to virgin coal lands, but the remarks and deductions will apply equally to operating coal properties which may be under examination.

1. Titles, Royalties, Etc.

The title will be held under either freehold or leasehold, each of which may be subject to the payment of a royalty to the Government controlling them. This royalty may be varied at the will of the Government. At the present, it does not exceed $7\frac{1}{2}$ cents per ton of coal mined and shipped, and some of the freeholds are exempt. Leaseholds from the Dominion carry an imposition of 5 cents per ton.

2. Geology.

The coal beds of Western Canada embrace periods from the Lower Cretaceous to the Tertiary. It is desirable to learn the geological age of the beds under examination, as this has its economic bearing.

3. Quality of Coal.

(a) **Sampling the Seam or Seams.**—The history of the sample should be minutely recorded. A legitimate sample can only be taken from a clean face of coal, across its full width, or such part of its width as it is deemed advisable to exploit. It is allowable, however, to eliminate those undesirable bands of rock, dirt, or "bone" which may be excluded from the shipping coal either during the process of mining or by later treatment. Hand specimens are misleading, and will serve only as museum exhibits, or may be as items in determining classification.

Sometimes the seam must be entered upon for some considerable distance from surface influences before a fair sample can be obtained. This applies chiefly to lignite and sub-bituminous coals, but friable or easily weathered bituminous or anthracite also come under the same category. Where, however, the latter two readily withstand erosion and weathering, samples may safely be taken from the surface.

There are, of course, conditions met with where the seams do not reach the surface, in which cases the samples must be procured by boring.

The portion or portions of the seam chosen for sampling should be free from abnormalities.

(b) **Analysis.**—For general, practical purposes a proximate chemical analysis, with a determination of British thermal units and coking properties is, by most, considered sufficient. I would, however, go fur-

ther and advise an ultimate analysis. Evolutions in the utilizations of coal are a natural outcome of competition and industrial exigency, and I predict that they will come to Western Canada in the not distant future. These will embody not only the fuller utilization of its heat units, but also of the by-products from coke and gas plants.

(c) **Physical Properties.**—As these have considerable to do with the ultimate marketing of the coal, they bear strongly on the value of the seam. The main features are: friability or firmness; weathering propensities; percentage of fines produced by comminution from handling and weathering; general aspect.

(d) **Combustion Tests.**—Practical tests under practical conditions give practical results.

4. Section of Measures.

A log, with details of the cross-section of the seam or seams and nature of enclosing rocks, is essential in determining the scheme of mining. The "dips" and "strikes" of the measures are part of this detail.

5. Extent of Deposit.

This is determined by figuring out the cubical contents of the seam or seams, so far as the stratigraphical features will admit, and no farther. The deposit should then be classified as follows:

I. Seams Capable of Present Economic Production.

(a) **Wholly.** This is possible when the seam presents no extraordinary difficulties in the way of development by reason of entry, quality, flexures, faulting, intrusions, thinning or pinching out, ventilation, gas, haulage, etc.

(b) **Partly.** Where development can be prosecuted only for a certain distance into, or in certain portions of, the seam, owing to one or more of the difficulties indicated above.

II. Seams Capable of Future Production.

(a) **Under Present Day Mining Methods.**—This may embody the "wholly" or "partly" sub-divisions above, including also those seams which present drawbacks by reason of their location, accessibility, or other physical considerations, and cannot, therefore, promise immediate profitable returns, especially if competition is keen. They may be accepted as resources for development when favorable changed conditions of market and price would warrant their exploitation.

(b) **Under Future Mining Methods.**—These seams comprise those which can be erased entirely from the roster as present workable projects owing to adverse conditions of quality, dimensions, and other geological and physical features, etc.; and this is apart from the question as to whether or not they may be economically accessible from point of attack. The time may come when such beds of coal may be drawn upon, but it is not at all probable that this will eventuate so long as the more favorable conditions obtain among competing coals.

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., September 20-25, 1915.

III. Seams to be Disregarded.

Included here are those which can show no practical value within a comparatively remote future. One cannot speculate on the distant future in the matter of heat-producing mediums which may then prevail, nor of the uses to which coal may then be put.

In estimating the amount of coal available in the seams, due allowance must be made for waste and mining losses. Under prevailing conditions in Western Canada this amounts to from 15 to 50 per cent. of the total content. This waste will undoubtedly be reduced.

Under the caption "seams capable of present or future production" must also be included those seams whose product, being amenable to economical mechanical treatment and rendered marketable thereby, would otherwise remain unsalable so long as the demand can be satisfied at lower, similar, or even higher prices by cleaner and more desirable rival coals.

6. Accessibility.

Access to the coal deposits is an absolute requirement, absence of which has militated against the successful operation of more than one otherwise excellent property. The cost of reaching the seam, transportation from the pit-mouth to the tippie, and then to its ultimate market, might preclude the possibility of successfully working the coal.

The chief factors to note are:

I. Transportation Facilities.—(a) Already available; (b) Already projected; (c) Feasibility of projected transportation from the standpoint of practicality; (d) Distance to market; (e) Freight rates; (f) Cost of construction, equipment, maintenance and operation; (g) Revenue to be derived, other than from the coal-carrying traffic (if required to be constructed and operated by the mines); (h) Effect on cost of coal per ton.

II. Mine Entry or Entries.—(a) Proximity to tippie and plant site; (b) Strategical position with regard to system of mining advocated or adopted.

Where possible, outside inclines are to be avoided, especially if they be of great length. There is always trouble with inclines, due to climatic conditions, accidents, up-keep, and consequent increased cost.

7. Plant Requirements.

The plant is the vital link between the mine and the market, and its effectiveness should be the resultant of the requirements of both. Therefore, in designing the plant, or evaluating one already constructed, these features of mine and market will decide its actual fitness and commercial value.

8. Method of Mining.

Certain maxima which are to be observed in the development of a mine are: Maximum output; Maximum cost; Maximum safety to men; Maximum safety to mine. These are interdependent and inseparable.

An enumeration of the salients which govern the initial and future methods to be adopted is given hereunder:

(a) Elevation—above or below sea-level; (b) Dips and strikes, with their variations; (c) Nature and extent of folding of strata; (d) Nature and extent of intrusions in strata; (e) Nature and extent of faulting of strata; (f) Nature and extent of other geological presentments; (g) Thickness of seam, with included rock bands (if any); (h) Structure of coal; (i) Proximity of other seam or seams in same measures; (j) Overbur-

den; (k) Surface conditions; (l) Ventilation requirements, including gas and dust conditions; (m) Liability to mine fires; (n) Haulage considerations; (o) Water disposal; (p) Extent of workings; (q) Cost of supplies and equipment; (r) Market requirements as to quality; (s) Market requirements as to quantity; (t) Labor conditions; (u) Legal mining restrictions.

9. Cost of Production.

The cost of to-day can not be assumed as the cost of to-morrow; nor need the cost prevailing in any one case correspond with that obtaining in another, even in the same district, because never are the conditions identical. There are, however, certain temporarily constant factors, which, if taken in conjunction with the engineer's knowledge of the other details, will enable him to arrive at correct estimates.

I have purposely used the phrase "temporarily constant factors". The only fixed factor is rate of return of capital. Some of the others may be fixed for a certain period only, and in reality are variable. Some of these are:

(a) **Wages.**—This, for many years past, as we all know, has had an upward tendency; conversely, and this is statistically proven, as wages have increased, so has the producing capacity, per man, decreased.

(b) **Strikes.**—A recurrent condition concomitant with coal mining.

(c) **Supplies for maintenance and equipment.**

(d) **Unforeseen contingencies** arising in the strata, such as pinches, faults, folds, intrusions, gas emanations, etc., etc.

(e) **Unforeseen contingencies** arising in the mines themselves, and any other adverse conditions of those items enumerated in Division 8 preceding (Method of Mining), or due to plant failures. This variable has wide limits.

(f) **Gradually increasing cost**, due to haulage, timbering, track laying, ventilation, water disposal, producing efficiency, and the various other odd problems which accumulate as development proceeds and the more distant portions of the seam are exploited.

10. Plant Site.

The suitability of a site for the erection of a complete plant affects profoundly the value.

The proximity of water is, of course, desirable, and the facilities afforded for miners' residences and other accommodations bear their part in the economy of things.

11. Market.

Unless the market be sufficiently stable to assure the continuous operation of the mine on the scale originally provided for, which of course includes the return of capital and dividends, the value of the lands depreciates correspondingly. It may be that the capitalization and bonded indebtedness are out of proportion with the potentialities of the market, or, again, it may be that the latter have not been taken advantage of to the full.

The chances of securing and retaining a sufficient market for any given property are affected by the competition of other coals, petroleum, natural gas, peat, wood and hydro-electric power. It is such competition that will undoubtedly induce the development of new and more scientific methods of utilization, together with a more rational selling organization. These remarks are peculiarly applicable to Western Canada.

General Remarks.

In evaluating a coal area, due regard must be given to the elimination of such portions as are in no way useful. For instance, a property may be altogether economically inaccessible. Again, it may be accessible at one point, but the limit to which haulage can be carried with profit will determine that part of the area which alone is commercially valuable. In a certain case that I have in mind, where the seam is steep-pitching, thick, regular, and enclosed by good walls, mining has been prosecuted for over 2½ miles along the strike, and there is no reason why it could not be pursued for twice this distance. Haulage and timbering expense will probably be the chief items of expense which will decide the limit of exploitation from the present pit-mouth. Ventilation at this mine, I might say, is secured by advancing the fan along with the workings.

When the overburden is of such thickness and of such a nature that great weight must be supported, and when occlusions of gas are apt to be troublesome, owing to sudden outbursts, and where the ventilation is extremely difficult, we then have another phase which may absolutely prevent the carrying on of mining. Or again, the dimensions of pillar support re-

$$500 \times 250 \times 40$$

— equals 666.6 acres.

$$11 \times 0.75 \times 1000$$

At the end of the term there would therefore be 4333.4 acres of the land which remained unworked, and upon which lease rental has been paid for the full period. For further purposes of illustration, let us assume this to be 4,000 acres. The government rental is \$1.00 per acre per annum, or \$4,000 yearly, for 40 years. This sum, if otherwise invested at 5 per cent. per annum, compounded yearly, would have amounted at the end of the 40 years to \$483,100.00.

All useless expenditure may be treated in the same manner, and similarly charged up to capital account.

I have intimated that the actual value of the mine plant is not in excess of its net earning capacity. If too small, it is deficient; if too large, the superfluous equipment may fairly be appraised at scrap value.

Likewise, I might assume that the coal rights should be evaluated only upon the basis of net earnings, after all other estimates, expenditures and the capitalization have been determined.

For the better elucidation of this, I have prepared a statement, which accompanies this paper, and which is but a tabulation of six purely hypothetical cases. In

YEARLY STATEMENT

Working days per year	Output per working day (tons)	Output per year (tons)	Acreage of leasehold	Cost of Plant and equipment	Depreciation of Plant and Equipment	Cost of Mining per ton	Selling price per ton	Dividend in per cent of Cap.	Receipts Total output sold at \$2.50 per ton	Expenditure					Paid Up Capitalization on basis of 0% Dividend	Evaluation of Coal Rights	
										Cost of Mining at \$2 per ton	Lease Rental at \$1 per acre	Depreciation and repairs	Dividend	Total		Total (Capital less cost of plant, etc.)	Per acre
175	1,000	175,000	1,000	\$200,000	12%	\$2.00	\$2.50	10%	\$437,500	\$350,000	\$1,000	\$13,000	\$73,500	\$437,500	\$735,000	\$535,000	\$535.00
115	1,000	115,000	1,000	200,000	10%	2.00	2.50	10%	287,500	230,000	1,000	10,000	46,000	287,500	460,000	260,000	260.00
75	500	87,500	1,000	200,000	10%	2.00	2.50	10%	218,750	175,000	1,000	10,000	32,750	218,750	327,500	127,500	127.50
125	500	62,500	1,000	200,000	10%	2.00	2.50	10%	156,250	125,000	1,000	10,000	20,250	156,250	202,500	2,500	2.50
50	250	37,500	400	50,000	12%	2.00	2.50	10%	93,750	75,000	400	2,500	15,850	93,750	158,500	108,500	271.25
150	150	22,500	1,000	40,000	12%	2.00	2.50	10%	56,250	45,000	1,000	2,000	8,250	56,250	82,500	42,500	42.50

quired may be so large in proportion to the coal extracted, that the slow development proves a deterrent. We have illustrations of these.

There has not, as yet, been evolved in our Western interior mining an economical process for replacing the coal pillar supports, such as sand filling, etc. Long wall mining, however, in some of the thinner seams, might well be substituted for pillar and stall.

Operating shafts sunk through rock would handicap the operations with this initial dead expenditure, in competition with other producers who are not under the necessity of such outlay.

Where shafts or slopes, on the other hand, are driven in coal throughout, the sinking is in the nature of development, and the increased cost, due to winding, over and above that of gravity planes in other mines, would not be such as to preclude successful competition.

If the coal concession be a leasehold with a limited life, the acreage which can be mined during that term is all that can be accounted valuable. This must be figured upon the basis of an assumed annual output. Let us make this clear by a hypothetical case:

The amount of leased land, 5,000 acres; thickness of workable coal, 11 ft; mining losses, 25 per cent.; coal content of seam per acre, 1,000 tons per foot of thickness; daily output, 500 tons; working days per year, 250; term of lease, 40 years.

Then at the termination of the lease there will have been worked out

this statement I have shown how to arrive at the evaluation of the coal lands per acre, after assuming as fixed the various other items, namely: number of working days, output, acreage of holding, cost of mining, selling price, dividend percentage, total receipts, total expenditures, depreciation of plant and capitalization.

Although the tabulations have been arranged to suit leased, prairie sub-bituminous or lignite coal mines or lands, the principle involved may be applied equally to any property, and this is my basis of evaluation of coal concessions.

I would wish, particularly, to draw attention to the fact that I have fixed the capitalization upon the basis of actual capital outlay. Should there be a bond issue, this would reduce the capitalization by the amount that it replaced.

The prime object of all such papers as this I have the honor to present before the International Engineering Congress, is to incite profitable discussion, and thus to stir up interest in the betterment of the industry. I have no doubt that in Western Canada, and in the Northwestern States, coal-mining suffers from identical maladies. We can not and must not blink the fact that disregard of the true principles of evaluation has been a contributory cause in crippling the industry. Whilst we are urging our respective Governments to help us, we must not forget that we have our own clear duties to perform. Not the least of these is preaching the gospel of practical common sense in appraising coal lands.

GREAT MINING ACTIVITY IN THE UNITED STATES

To-day the U. S. Geological Survey is making public its usual estimate of mineral production for 1915 in the form of a separate statement for each of the more important mineral products.

A review of these statements confirms Secretary Lane's comment of last July to the effect that the mining revival is in full swing. In the Western States alone the metal production shows an increase in value of more than \$130,000,000 over the corresponding figures for 1914; and the year's increase in output for the principal metals measured in value is more than \$250,000,000. Moreover it is not unreasonable to expect that when the full returns for all mineral products are compiled they will show that 1915 was the country's most productive year in the mining industry. The total may even reach two and one-half billion dollars.

In the response to bettered conditions the production figures for copper, iron and zinc show the largest increase.

Copper.—The copper mines passed all records for previous years, the 1915 output having a value of \$236,000,000, or \$83,000,000 more than the value of the production for 1914. The statistics and estimates received place the output of blister and Lake copper at 1,365,500,000 pounds, or more than 120,000,000 pounds in excess of the largest previous production and eighteen per cent. above last year's figures. Only twice in the history of copper mining has there been a larger increase in quantity of metal produced.

Iron.—The total shipments of iron ore from the mines in the United States in 1915 are estimated to have exceeded 55,000,000 gross tons, an increase over 1914 of more than 38 per cent. Based on the same price as received in 1914 this represents an increase in total value of about \$27,645,000. The increase in pig iron is estimated at 6,500,000 tons, with a total increase in value of pig iron production of more than \$120,000,000.

Zinc.—The U. S. output of zinc (spelter) made from domestic ores was larger than ever before being about 425,000 tons worth \$120,000,000 as compared with 343,418 tons in 1914, an increase of about 82,000 tons or nearly 25 per cent. in quantity and of \$85,000,000 in value. Production was increased during the latter half of the year, as the production during the first half was at the rate of 415,000 tons annually and at the rate of 436,000 tons during the last half.

Lead.—The U.S. output of refined pig lead from domestic ores was about 515,000 tons worth about \$48,500,000 as compared with 512,794 tons in 1914, an increase of only 2,500 tons in quantity but of \$8,500,000 or 20 per cent. in value. The production of antimonial lead was 20,550 tons as compared with 16,668 tons in 1914, an increase of 3,882 tons or 23 per cent. in quantity and an increase in value of nearly \$2,000,000.

Gold and Silver Increases.—The annual preliminary estimates on the production of gold and silver in the United States, made jointly by the United States Geological Survey and the Bureau of the Mint, are not yet complete, but early figures based on reports from the mines indicate an increase in mine production over that of 1914 of over \$7,000,000 in gold, principally from

Colorado, California, Alaska, Montana, and Idaho, and an increase in mine production of silver of fully 4,000,000 ounces, chiefly from Montana, Utah, and Arizona. This increase in gold production may bring 1915 up to the record year of 1909, when the gold output of this country was nearly \$100,000,000.

Quicksilver also had its best year in 1915. The quantity increased 25 per cent. over 1914, but the value of the output more than doubled owing to the much higher prices. The estimated production was 20,681, flasks of 75 pounds each, valued, at the average price for the year—the highest in the last 40 years—at \$1,768,225. In value, this domestic production was the highest since 1881 and in quantity the largest since 1912.

Coal.—The production of bituminous coal and anthracite in 1915 is estimated to have increased between 4 and 5 million short tons, or less than 1 per cent. The quantity of bituminous coal mined increased about 6½ million tons and that of anthracite decreased over 2 million short tons. Owing mainly to steady demands for export coal and for coke for steel making, the output in Pennsylvania, West Virginia, Kentucky, and Alabama increased over last year, but little change is recorded in other eastern States. The region west of Ohio, including the Mississippi Valley, shows a general decrease, Colorado being the only Western State to show betterment.

Coke.—Connected with the coke industry was the completion during the last summer of a number of large plants for the recovery of benzol from by-product coke-oven gas. This gives the United States its first output of this material, so important as a raw material in the manufacture of high explosives and chemical dyes, and the amount of this product will be reported later.

Petroleum.—Preliminary estimates of the total output of petroleum in the United States in 1915 indicate a slight increase over the corresponding output in 1914. It is believed that the total petroleum yield of the United States in 1915 amounted to 291,400,000 barrels, of which quantity it is also estimated that 267,400,000 barrels was marketed and 24,000,000 barrels placed in producers' field tankage during the year.

The sulphuric acid industry in 1915 presented interesting development. In spite of the abnormal demand and higher prices in the latter half of the year, much of the sulphuric acid had been contracted for or was consumed in the factories where made. The estimated production indicates an increase of 6½ per cent. in the three common grades, but more than 100 per cent. in the strongest grades.

The estimate of Portland cement output in 1915 indicates shipments from the mills of 86,524,500 barrels, an increase of one-tenth of one per cent. over 1914. There was a slight decrease in production and this, with the appreciable decrease in stock, indicates a more conservative trend in the industry, which in the preceding few years showed a tendency to overproduction. Prices generally averaged a few cents lower per barrel in 1915 than in 1914, although toward the end of the year prices were substantially increased, and the outlook for 1916 is brighter than for several seasons.

Perhaps the most notable item in the year's record is the stimulation of metal mining in the Western States.

Almost without exception the increases in production were large and in several States 1915 was the best year on record. In Arizona, which leads in copper, the output of that metal exceeded the previous record production of 1913. California continues to lead in gold and had the largest yield in 32 years, and with one exception in half a century. In Montana and Arizona record outputs of silver are reported and in Alaska the increased production of gold and especially copper made 1915 a much more prosperous year than even 1906 when Fairbanks and Nome were yielding their greatest returns of gold from bonanza placers.

QUICKSILVER IN 1915.

The United States output of quicksilver in 1915, based on preliminary figures collected from the individual producers by H. D. McCaskey, of the United States Geological Survey, was 20,681 flasks of 75 pounds each, valued, at the average domestic price for the year at San Francisco (estimated at \$85.50 a flask), at \$1,768,225. Compared with the Survey's final statistics for 1914, which gave a production of 16,548 flasks, valued at \$811,680 (the smallest since 1860), the output of 1915 shows an increase of 4,133 flasks in quantity and of \$956,545 in value. The value therefore more than doubled, owing to the greatly increased prices demanded, but the quantity increased only about 25 per cent. The production was the largest in value since 1881 and the greatest in quantity since 1912. On comparing the production of 1881 with that of 1915 in value, it is interesting to note that it required 60,851 flasks at the average price of \$29.83 per flask for that year to exceed in value the much smaller output at the greatly enhanced average price for 1915.

The European war directly affected the quicksilver industry, first by greatly increasing the demand for the metal in the manufacture of fulminate for explosives, and, second, by reducing the imports of foreign supplies. The net result has been steadily increasing prices and encouragement to producers to operate at maximum capacity.

The average San Francisco domestic market price is estimated at \$85.50 for 1915, against \$49.05 for 1914. With the exception of the year 1874, when the average price was \$105.18 per flask of 76½ pounds, the average price of 1915 was the highest since the beginning of the industry in 1850, when the average for the year was given as \$99.45.

The monthly averages for 1915 show a rise from \$51.90 in January, to \$78 for March, a decline to \$75 for May, a recovery and rise to \$95 for July, a decline to \$91 to September, and steady increases since to an estimated price of \$119 for December. Though there have been temporary setbacks the tendency has therefore been steadily upward, and the year ends with prospects of still higher prices as the demand continues.

HIGH SPEED STEELS.

A very important group of the rare metals, known as the steel-alloying metals, includes chromium, cobalt, nickel, tungsten, vanadium, and of less importance, molybdenum and titanium. By the use of these metals wonderful alloy steels containing six or seven metals have been evolved, the "high speed" steels, by the use of which one man now does as much work with metal-cutting machinery as could formerly be done by five men.

These alloy steels have been largely though not wholly developed in the United States. The tremendous quantity of special steel ordered in that country by the war-

ring nations has shown the extreme importance of the steel-alloying metals and prices have increased by leaps and bounds.

The alloy tool steels are now sold as high as \$2 and \$3 a pound as compared with 50 to 60 cents a pound formerly, and meet no competition from the fine carbon tool steels formerly used. For carbon steels with established reputations between 10 and 20 cents a pound was considered a good price.

For the "high speed" tool steels, chromium and tungsten are essential; vanadium, cobalt, and molybdenum desirable. Tungsten and vanadium can be produced in this country easily, at least for present demands; molybdenum, chromium, and cobalt for at least a portion of our needs.

Alloy steels of simpler composition are used in many forms of machinery with great benefit. All shoes and dies in stamp mills and the tires of rolls used in crushing ores are made from steel containing chromium. Many of the best automobile axles and springs, locomotive frames and springs, and other machine parts that must stand hard usage and which must be reliable are made from steels carrying vanadium or chromium and vanadium.

GRANBY CO.'S BONANZA MINE.

Included in the Granby Consolidated Mining, Smelting and Power Co.'s annual report, which was reprinted in The Canadian Mining Journal of November 15th last, was a report by Mr. H. J. C. MacDonald, superintendent. Anyox, B.C., who in his brief account of the company's Bonanza mine, observed: "The value of the Bonanza mine, as an addition to the reserves of the Hidden Creek mine, tributary to the smelter at Anyox, has not been sufficiently emphasized in the former reports."

During the field season of 1913, Mr. Donald G. Forbes, a private practising mining engineer, was engaged in making examinations of certain mineral properties in the Coast district of British Columbia, and among the many properties he then visited was the Bonanza, concerning which he reported (vide Annual Report of Minister of Mines, British Columbia, 1913, pp. K83-84):

"The Bonanza mine, owned by Henry Doble, is situated on Bonanza creek, at an elevation of 200 ft. above and about one mile from salt water.

"Several small bodies of chalcopryite, pyrite and pyrrhotite intimately associated with small diorite dikes, have been exposed by a small creek entering Bonanza creek on the north side. The country exposed at this point consists of mica-schist containing small bedded veinlets of quartz and containing some pyrite and chalcopryite. The schist lies fairly flat, the mineralized portion being 50 to 60 ft. in thickness.

"The development work has been done with the idea of tracing this deposit downward, and several tunnels have been driven with that end in view, without satisfactory results.

"During the past year the property has been under option to the Granby Co., and has been prospected with a diamond-drill, with the result that the deposit has been proved to be a blanket formation. The solid bodies of iron and copper pyrites above-mentioned occur on both sides of the dikes and contrary to the experience in the development of the Hidden Creek properties, two miles distant, the dikes appear to the writer to be responsible for the aggregations of ore and the mineralization of the surrounding mica-schist.

"Two samples of clean ore returned: (1) Copper and iron pyrites—gold, 0.08 oz.; silver, 1.6 oz.; copper, 6.2 per cent. (2) Copper and iron pyrites—Gold, 0.02 oz.; silver, 2.8 oz.; copper, 1.7 per cent."

PERSONAL AND GENERAL

Mr. Maurice W. Bacon, of Spokane, Washington, has resigned as general manager of the Stewart Mining Co., operating in the Coeur d'Alene district of Idaho, and has been succeeded in that capacity by Mr. Wm. Beaudry. Mr. Bacon has been active in connection with the promotion of a company to acquire and further develop a group of copper claims situated in Quatsino mining division, Vancouver Island, B.C.

Mr. David W. Brunton, who several weeks ago was on the coast of British Columbia, is back in Denver, Col.

Prof. R. W. Brock, of Vancouver, B.C., dean of the Faculty of Applied Science, University of British Columbia, has arranged to give his time and attention to military matters, and Mr. Stuart J. Schofield, of the Geological Survey of Canada, has been appointed professor of geology at that university. Mr. Schofield spent the last field season making geological investigations in the eastern part of the West Kootenay district of British Columbia.

Mr. Lorne A. Campbell, of Rossland, B.C., general manager for the West Kootenay Power and Light Co., operating in West Kootenay and Boundary districts, has been appointed Minister of Mines for British Columbia.

Mr. Henry Clark, of Victoria, B.C., representative of Canada of Head, Wrightson & Co., Ltd., of Stockton-on-Tees, England, consulting engineers and contractors, expects to leave Victoria for Japan on January 11th for a visit to the latter country.

Mr. S. Duncan Ellis, formerly of Toronto, has advised his parents in Victoria, B.C., that he has been in the trenches in France, serving as a lieutenant of the Royal Engineers.

Mr. David Elliot, of Dawson, Yukon territory, superintendent for the Treadgold Mining Co., is reported to have gone to London, England.

Mr. W. H. Falding, of Rossland, B.C., who for a comparatively long period has been in charge of the accounting department of the office of the Le Roi No. 2, Ltd., is retiring from that position.

Mr. Chas. Graham, superintendent for the Corbin Coal and Coke Co., operating a coal mine in Southeast Kootenay, British Columbia, has secured leave of absence from his mining duties and obtained a lieutenancy in the No. 2 Tunnelling Co., Engineers, that Major R. W. Coulthard, of Calgary, is raising in Western Canada. Mr. Thos. McGuckie, formerly of Nanaimo, will have temporary charge of the coal mines at Corbin.

Mr. A. D. Hughes, long associated with the management of the placer-gold properties of the North Columbia Gold Mining Co., in Atlin camp, British Columbia, is spending the winter in California.

Mr. W. H. Trewartha-James, of London, England, formerly general manager for the Tyee Copper Co., with headquarters in Victoria, B.C., has lost his son Derrie, who was killed in Flanders last autumn.

Capt. Harry Johns, of Spokane, Washington, for years superintending mining operations in Boundary and West Kootenay districts of British Columbia, has been in Portland, Oregon, lately, in connection with financing a mining enterprise that is being prosecuted by Keffer & Johns, mining engineers, of Spokane.

Mr. J. P. Keane, who is operating the mill at Rosebery, Slocan Lake, B.C., as a custom concentrator, has notified the Slocan Board of Trade of his intention to launch a movement having for its object the erection of a zinc-reduction plant in Canada.

Mr. D. Matheson, for some time superintendent of the Silver King mine near Nelson, B.C., when it was being worked by the Consolidated Mining and Smelting Co., is now in charge of development work that company is having done at its Ottawa mine, in Slocan City mining division.

Sir Richard McBride has resigned as Premier and Minister of Mines for British Columbia and will shortly leave for London England, where he will succeed the Hon. J. H. Turner as Agent General for British Columbia. One most beneficial feature of Sir Richard's long tenure of office as leader of the Government of British Columbia was his persistent determination to allow no legislative tinkering with the mining laws of the province.

Mr. J. W. D. Moodie, of Britannia Beach, B.C., vice-president and general manager of the Britannia Mining and Smelting Co., has been in the East for several weeks. The headquarters of those in control of the Britannia company is New York City.

Lieut. J. H. Roaf, of the 6th Regiment, D.C.O.R., Vancouver, B.C., was one of thirty who on December 6th at Victoria commenced attendance at a Royal Military course for those desiring to qualify for the rank of captain. Lieutenant Roaf has long been connected with the management of coal mines in British Columbia.

Mr. Wm. Thomlinson has returned to his home at New Denver, British Columbia, after having been for about a year at San Francisco, California, where he was engaged first in assisting in arranging the very fine exhibit of Canadian minerals in the Canadian Pavilion at the Panama-Pacific International Exposition, and afterward in giving to thousands of visitors much information relative to the great variety, extent and value of the mineral resources of the Dominion.

Mr. Wm. R. Wilson, of Fernie, B.C., general manager for the Crow's Nest Pass Coal Co., of Toronto, has been in California recuperating after having been troubled for a time with a mild attack of pneumonia.

Mr. Hugh M. Wolfen has been appointed to charge of important activities at Pittsburgh, Pennsylvania, of the United States Bureau of Mines, in connection with the mine safety work the Bureau has in hand there. For a year or more Mr. Wolfen had been engineer to the California State Industrial Accident Commission, in which office he has been succeeded by Mr. Paul Higgins, also of the staff of the Bureau of Mines and who is another enthusiastic mine safety worker. When in charge of the Bureau's mine-rescue training station on the campus of the Washington State University, Seattle, Mr. Wolfen came into close and friendly relation with a number of coal mining men from British Columbia.

Capt. H. C. Anchor is at South Porcupine.

Mr. Geo. J. Miller, who bought the McDonough claims at Boston creek, has started to build camps and will build a small mill.

Mr. H. W. Hardinge has been honored by the Franklin Institute of Philadelphia, for the City of Philadelphia itself, by being awarded the John Scott medal for the invention of the Hardinge mill. This medal is the oldest existent medal which is being awarded up to the present time. John Scott, of Edinburgh, died in 1816 and left a certain amount of award to the City of Philadelphia to be distributed in the future for improvements which would be of general mechanical benefit. The Franklin Institute of Philadelphia is the oldest scien-

tific association and on its committee and staff has some of the most celebrated men of the United States. Hence an award from them is a signal honor.

Chas. E. Van Barneveld, Chief of the Department of Mines and Metallurgy of the Panama-Pacific International Exposition, is visiting Washington and New York and will return to Berkeley, California, to take up his work as Professor of Mining at the College of Mines, University of California.

Mr. Julius M. Cohen, not Mr. S. W. Cohen as reported in our last issue, has been appointed manager of Croesus Gold Mines, Ltd.

Mr. Geo. R. Rogers, who is developing a property in the Elk Lake district, was in Toronto last week. His address is Wigwam, Ont.

Mr. A. A. Cole, of Cobalt, has been nominated for the Presidency of the Canadian Mining Institute.

Mr. T. W. Gibson, Deputy Minister of Mines of Ontario, has been nominated as Vice-President of the Canadian Mining Institute.

Mr. W. E. Segsworth, Toronto, has been nominated for councillor of the Canadian Mining Institute.

Mr. Fraser D. Reid is superintendent at the Coniagas mine, filling the place of Colonel R. P. Rogers, who is in charge of the tunneling company of the Royal Engineers.

Colonel R. P. Rogers, who is at Pembroke with his company, has had the misfortune to break his collar bone in a fall.

Mr. T. P. McNamara is mine superintendent and Mr. Ralph Scott mine engineer at Dome mine.

Mr. Geo. B. Church is at Juneau, Alaska, examining properties there.

Mr. H. L. Taylor, president of the Porepine Imperial mine, has returned to New York after a visit to the mine.

Mr. Frank Loring is at the La Belle mine, Goodfish lake.

Mr. F. J. Bourne has returned to Cobalt after a visit to Toronto and Ottawa.

Mr. F. C. Dyer, of the Department of Mining, University of Toronto, demonstrated at a meeting of the Toronto Branch of the Canadian Mining Institute on December 11th a number of experiments illustrating flotation phenomena. The experiments provoked an interesting discussion on flotation methods.

SOME OCCURRENCES OF OIL IN BRITISH COLUMBIA.*

By J. B. Tyrrell.

The occurrence of vast pools of oil on the Pacific slope in the State of California has stirred the imagination of many of those living farther north, and during recent years some exploratory work has been done in the province of British Columbia in the hope of finding some northern continuation or representatives of the pools which have yielded so much oil to our fortunate neighbors on the south. In prosecuting exploration in British Columbia, some investigations have been conducted throughout the country near the mouth of the Fraser river, and some interesting results have been brought to light by these explorations.

*From a discussion of a paper by C. E. Weaver, published in December bulletin of A. I. M. E.

In the southwestern corner of British Columbia, through which the Fraser river flows westward to the sea, there is a comparatively flat-lying area bounded on the north by granite mountains of Jurassic age, and on the east by the Sumas and Chilliwak mountains, composed of somewhat older rocks. To the south this area extends across the International Boundary line into the State of Washington, a rather high ridge of glacial debris extending east and west near the International Boundary line. This comparatively small triangular area of about 700 square miles in Canada is underlain by Tertiary sandstones and shales with a total thickness of several thousand feet. These sandstones and shales do not appear to contain any fossil remains of marine animals, but they do contain trunks and fragments of trees and land plants which have been altered to lignite or low-grade coal, this coal occurring at numerous horizons throughout the formation.

The mode of formation of these Tertiary beds would appear to have been about as follows: In pre-Tertiary times a great submerged valley extended along to the south of the Jurassic mountains. Into the head of this submerged valley or bay the early representatives of the Fraser river and other streams emptied, carrying down into it loads of detritus worn from the upper portions of the river valleys, and this detritus was spread over the floor of the bay, while around the margin of the bay grew forests whose trees fell into the edge of the water. While the streams were thus discharging their loads of sediment, the land was gradually sinking and the sediment was gradually accumulating to a greater and greater thickness. The trees growing on the shore fell in the water and were also included in this sediment, and finally formed irregular beds of lignite of greater or less extent, each bed marking the position of an old shore line of the time when its vegetation was buried. Thus the bay was gradually filled up with beds of sand and gravel, with included seams of coal or lignite, having a total thickness of several thousand feet.

After these Tertiary beds were deposited there was a rise of the land of 1,000 ft. or more, and the Fraser river cut out a canyon along the foot of the northern mountains to a depth of about 1,000 ft., and at the same time the surface of the adjoining land to the south was cut into hills and valleys, but there was no perceptible warping of the land in this district, and the beds retained the horizontal attitude in which they originally had been deposited. Subsequent to the formation of the canyon of the lower Fraser river, the land was again depressed to its present altitude, and the old canyon of the Fraser river was filled by glacial debris brought down from the mountains to the north of it.

At some time subsequent to the deposition of the Tertiary sands and clays, which are known as the Puget group, dikes of quartz-andesite were intruded through them near their northern border. These dikes also cut the beds of lignite, and subjected them to a process of distillation, giving rise to a dark oil which is still occasionally found exuding from the sandstone in the vicinity of the city of Vancouver and in the country to the east of it. It is not likely that this oil has any commercial significance or value, but its mode of occurrence as a distillate of lignite through the influence of hot dikes, is of interest.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

Gold production.—According to the closest figures that can be obtained the gold production from Porcupine, Kirkland Lake and Munro Township will be over eight million dollars. It is quite probable that it will exceed eight million and a quarter dollars but at the time of writing the production for December has to be estimated and the growing production from scattered mines makes the difficulty of close figuring more real than it was when Porcupine was the sole producer. There were no less than nine producers from the Porcupine area and two from outside, namely, the Tough-Oakes and the Croesus gold mines. Of the eight million and a quarter produced, Porcupine contributed between seven and a half and seven and three quarter millions in gold.

Hollinger.—The experience with the metal balls in the tube mills at the Hollinger is not yet conclusive enough to justify them being installed throughout the mill. It is true the duty per stamp can be raised but the difficulties in the wear of the tube mill liners, the extra power required and various other factors makes the problem yet one not entirely solved. The metal balls certainly have great crushing possibilities and the temptation to use them is very great. Experiments are still proceeding and will continue for some time.

Dome.—The new central shaft at the Dome Mines is making very rapid progress. Since the first of November when the ground was first broken sinking has been conducted at the rate of five feet a day. The shaft is now down to between 225 and 250 feet and it is expected that all the levels will be connected up by March first. Taking the average of all the levels to the 7th about 150 of cross cutting is required to connect up the old shaft to the new. From the 5th, 6th and 7th levels of the old shaft cross cuts have been run to the new central shaft and raises now being put up from these levels. At the 5th level the 36 x 54 new Buchanan crusher is almost ready to commence primary crushing. It has a capacity of 250 tons an hour to twelve inches and about 150 tons an hour to six inches. The new central shaft consists of two hoisting compartments, one man-way and a pipe and ladder way. The work in connection with the new shaft is being rushed as fast as possible and in consequence less development is taking place in other portions of the mine. No less than 70 to 75 per cent. of the ore going to the mill is still coming from the old Dome glory hole.

McIntyre.—Profits at the McIntyre for November were slightly lower than for October according to the official statement just issued. This was due to slightly higher operating costs per ton. They went up from \$4.01 to \$4.07 per ton.

	November.	October.
Tons milled	8.657	8.741
Value per ton \$	7.29	7.48
Gross value	63,310.00	65,382.00
Recovery	60,284.00	62,265.00
Per cent.	95.52	95.23
Operating costs	\$35,234.00	\$35,051.00
	4.07	4.01
Operating profit ...	25,050.00	27,214.00

West Dome.—It is announced on good authority, that Mr. Jacob Field a well-known operator on the New York market has obtained large holdings of large blocks of stock in northern mines. It is understood that he has taken up a large block of shares in the West Dome and he has also purchased from the same holder, quite a little of the issued stock of the Peterson Lake Mining Company. If this is so there is little doubt that the West Dome will be among the prospects in the Porcupine camp that will start up early next year.

The Porphyry Hill, once belonging to the Preston East Dome, latterly owned by the original syndicate to which it reverted, is now under option to Mr. Clifford Smith and his associates. From the Porphyry Hill there have been shipped during the past two years four cars of ore which would average more than \$100 to the ton. This ore has not come from old workings, but from new veins opened up by Mr. William Ophir and his associates in the Porphyry Hill.

The Croesus Gold Mines had cut its vein at the 200 foot level of the mine. The vein here is two feet wide and sampling shows that it still gives a very high-grade of milling ore. Good milling ore and also patches of the extraordinarily rich ore that has made this claim so well known, has been developed at both directions on the 150 sub level. It is to be noted that after the very high-grade ore had been hand picked out of the vein the heads of the mill run made at the Pyramid mill went over \$40 to the ton. With the cutting of the vein at the 200 foot level there is now every confidence that the Croesus will continue to hold good values to a considerable depth. On the other hand the development of the veins laterally is not likely to be of any great extent. Since the roads froze up it has been possible to get in supplies without much difficulty and traffic into this camp has been resumed with a good deal of vigor.

Munro Consolidated.—Upon the Munro Consolidated claims, also in Munro Township good ore has also been found and is being developed.

Prospecting.—Owing to the regulation not insisting on winter work for assessment there are very few prospectors in the bush this winter in spite of the much greater potential value of the claims. There are prospectors in Boston creek still staking and looking for claims and there are some in Munro Township too, but apart from that there are hardly any men at all in the bush this winter. This by no means goes to show that there is lack of interest in prospecting; but owners of claims recognize not fifty per cent. of the value of work can be done while the snow is on the ground. It is true that much of the assessment work will be due to be done in the spring before the snow goes but every one is putting it off until the last minute. There will be a wild rush back into the bush to do assessment work next spring, as very few claims of any value will be allowed to lapse. This inactivity is more apparent in the newer fields than in the old. Kowkash for instance, is almost deserted and beyond the claims that have got beyond surface exploration, very little development is being done.

Kirkland Lake.—Apart from the Tough-Oakes in Kirkland Lake there are now four other properties

working still. These are the La Belle at Goodfish, the Teek-Hughes at Kirkland lake and the Kirkland Lake Gold Mines and the old Swastika. It was considered most probable that some arrangement might be made whereby further power would be available from a hydro electric plant and the delay has retarded development to some extent on the Teek-Hughes. In the meantime the construction of the mill there is being pushed on vigorously but the mine as yet has not been reopened. Placing of mill machinery will commence early in the new year.

Under the direction of Mr. Floyd Weed, who was for several years manager of the Bailey Cobalt mines, the Kirkland Lake Gold Mines shaft has been dewatered and will shortly commence drilling. The Kirkland Lake had a small but complete plant on the property and no further installation will be necessary for some time to come.

La Belle.—For the La Belle Gold Mines at Goodfish lake two large tubular boilers arrived at Swastika at end of last week and have now been taken over the snow roads. A compressor will follow soon. As initial development work was carried out with a very primitive plant it was thought best that after enough development had been done to justify the purchase of the property, to merely do surface work until such time as the whole plant can be taken in. The prospects at this property are most encouraging. At the bottom of the shaft at 150 feet good ore will run 11 dollars across 15 feet.

Swastika.—At Swastika mine work was resumed at the 200 foot level about six weeks ago and cross cutting and drifting to find new ore bodies has been in progress for the last month or more. Now the water will be taken out down to the 300 ft. level so that further exploration can be proceeded with.

Activity apart from prospecting has never been more pronounced in Kirkland Lake than to-day. A large quantity of freight is going over the roads every day and the force of men now employed at the mines is considerable. A new townsite has been established at the confluence of the Goodfish road and the road to the Tough-Oakes mine from Swastika. Next spring the post office will be established and also a school. A small settlement has sprung up around the Tough-Oakes mine itself and promises to develop into a good sized village.

The Tough-Oakes Gold mine has now paid two dividends and has three well defined vein systems. It is remarkable, that during the month of November and most probably during December, the mill which is treating 110 tons a day will be run entirely on development ore. It is due to the fact that practically all the drills running on development are in ore. Raises are being put through from the 400 to the 300 foot level in order to block out ground for stoping. These raises are in remarkable ore. On the 400 foot level for a distance of 150 feet, the ore will run \$51 dollars over a width of 54 inches. The vein matter is divided into three branches and the whole width between is good milling ore. The veins themselves are narrow but phenomenally rich and there is gold in the porphyry. It is a significant fact that despite the remarkable ore on the upper levels in the sedimentary rock the ore across a stoping width is richer in the porphyry than in the conglomerate. Practically all the ore now being mined is in the porphyry. The stoping is confined entirely to

the number two vein which was the only vein opened up until recently. From the 200 foot level a long cross cut has been run towards the mill at a distance of 600 ft. which cut the No. 3 vein and this ore body has now been proved up for a distance of between 200 and 250 feet. The drifts both east and west are in great ore. The winze has been sunk near the end of the west drift and the ore here is most satisfactory. From the drift a raise is being put up through to connect with the drift near B shaft. A winze is also being put down on ore from the workings at B shaft. The use of B shaft will probably be discontinued for the winter and all ore mined in these workings will be dumped down the raise to the 200 foot level and then trammed to the shaft. At the time of writing it is expected that No. 7 vein will be cross cut at any moment. Owing to experience in other veins in similar contents the management is more sanguine that No. 7 vein will be at least as productive as No. 3 or No. 6. If this proves so the ore reserves of the mine will be trebled. Also if No. 7 vein proves as good as anticipations it is most likely that within a short time a new central shaft will be put down near the mill. It is now a distance of 6 to 800 feet to tram ore from No. 3 and No. 6 veins. The ore is then raised to the surface up an incline shaft and hauled back to the mill. As a large percentage of the ore comes from No. 3 and No. 6 and will increasingly do so, it is apparent that such a development would lead to economy. The mill is now treating 110 tons a day. By means of a simple device at the discharge end of the Hardinge tube mill Mr. Randall has raised the capacity of the ball mill from 80 to 110 tons a day. As a consequence the place in the mill where tonnage is apt to be arrested is at the tube mills. Heads are kept down to about \$20 and tails are running a little over a dollar a ton. About 4,000 tons a month is being hoisted by the main shaft of which three thousand is ore and a thousand waste.

COBALT, GOWGANDA AND SOUTH LORRAIN

Crown Reserve.—The Ontario Government has decided to grant the request of the Crown Reserve Mining Company and the royalty will be abolished. Since the company commenced operations the Crown Reserve Mining Company has paid 10 per cent. on the ore at the pit's mouth. It was pointed out to the Government some five or six months ago that under the altered conditions at the mine the Government was taking practically all the profits that were being made. The Crown Reserve Mining Company therefore received word that it has been decided to abolish this royalty but the Government reserves the right to reimpose it if conditions at the mine warrant it.

Chambers-Ferland.—Much better ore is being found at the Chambers-Ferland mine. A winze has been sunk from the 350 to the 400 foot level near the Nipissing line. It was sunk upon a strong vein of niccolite and smaltite with low silver content. As the winze was being put down another narrower but much richer vein came into the winze. The farther the winze was sunk the better has become the vein so that it is now about two inches wide and of 3,500 ounce ore.

The Reeves-Dobie at Gowganda is again being worked. Messrs. Sam Dobie and Reeves have sold out their

interest to a syndicate of which Mr. Christopherson of Gowganda is the Canadian representative. The syndicate purchasing the claim is substantial and it is probable that the old prospect will get a chance. Some tentative offers have also been made for the Bartlett mine.

Ophir.—Before the new year the Ophir Cobalt mine should be pumped out and ready for mining operations. It has been decided to resume work on this south eastern prospect. Before doing so, however, the old workings will be thoroughly re-sampled in order to discover the most likely place to strike further ore. Before the mine closed down several short high-grade shoots of ore were encountered but were not long enough to make mining profitable. There is also a good deal of milling rock in the mine to-day.

The Nipissing has decided to use their No. 81 shaft as a basis for operations on the ore to be cut near the Cobalt Lake fault. The old shaft will immediately be sunk to the 350 and 430 foot level before any cross cutting is attempted. A new head frame has already been erected.

BRITISH COLUMBIA

The resignation by Sir Richard McBride of the offices of Premier and Minister of Mines for British Columbia was announced on December 15. While it had been reported for a month or two that Sir Richard intended to follow this course, there was uncertainty about it, since the public announcement had been made by political opponents who had on several occasions predicted his retirement, and whose guesses previously had not proved to be based on fact.

As the year draws to a close, interest is being shown in some quarters in the matter of what the value of the mineral production of the province for the year 1915 will prove to have been. At the time of writing no estimate is available, but before the end of December it will be practicable to get a fairly good idea of the year's results. The year will have the advantage of higher average prices for some of the metals—copper, lead, and zinc, but the advance in silver did not come soon enough to give that metal a similar lift, so that it will most likely show to disadvantage this year as compared with 1913 and some earlier years. A comparison of coal and coke figures is expected to show a decrease in the year's output of coal, though coke will probably be higher than last year.

ATLIN MINING DIVISION.

Information received from Atlin is to the effect that conditions affecting the water supply for placer mining purposes were unusually unfavorable on the creeks on which operations were carried on. A very light snow-fall last winter and a warm early summer combined to make the length of time during which there was sufficient water for gravel washing shorter than in most seasons. Then the rainfall in summer and autumn was meagre, so there was little assistance to the hy-

draulicers from this source. However, it is estimated that the value of the gold recovered will be somewhere about \$300,000, as compared with a yield of \$322,000 in the 1914 season. Prospecting work was done on more than a dozen creeks that have not yet been found to be gold bearing to any considerable extent, and in some cases indications were found good enough to induce the making of locations and application for leases. While no particulars have been obtained relative to results of continued work on the Engineer gold-quartz property, it is understood that more rich ore has been found and the considerable value of the property further proved. It is reported that 20 to 25 men were employed and that the ore-shoots opened make it appear that there is more high-grade ore there than was earlier thought probable. The hydro-magnesite deposits near Atlin have again had attention, and a Vancouver city firm has shipped several hundred tons for experimental purposes.

LODE-MINING ABOUT HAZELTON.

Eight or nine properties shipped more or less ore during 1915, one of them on a comparatively large scale for a newly-opened mining district. Figures for the last quarter of the year have not been obtained, but it is known that the output from the Rocher De-boule Copper Co.'s mine on Rocher Deboule mountain up to the end of September was between 8,000 and 9,000 tons of copper ore, which was sent to the Granby Consolidated Co.'s smelting works at Anyox, Observatory inlet. The mine was operated under lease by the Montana Continental Development Co., of Butte, Montana. The terms of the lease, which was arranged for in August, 1913, provided that the lessee should equip the mine with certain machinery, construct aerial and surface tramways requisite for transporting the ore from the mine to the Grand Trunk Pacific railway, and develop the upper vein by a crosscut adit. In consideration for this development work and equipment the lessee company was to be permitted to extract all the ore it could during the term of its lease. As the stated term of the lease was only two years, and the lessees are still operating the mine, it would appear that either an extension of the lease was obtained or some other arrangement made.

The Silver Standard shipped between 100 and 200 tons of galena ore before winter set in. It may be there was further production after the snow fell, but if so no particulars have been received. This mine is situated on Glen mountain, about four miles from Hazelton. The Black Prince, on the same mountain made a small shipment, also of galena ore. The Silver Bell, Silver Cup, and Sunrise, all of Nine-mile mountain, each sent out galena ore, the Silver Cup more than 50 tons and the others smaller lots. The Coronado, on Hudson Bay mountain, and the Hunter group, in the Hunter basin, both in the neighborhood of Smithers, which is on the railway east of New Hazelton, were also small shippers, the latter of ore containing copper, gold, and silver. The Red Rose group, in the Rocher Deboule mountains had some 30 tons of ore taken out to the wagon road in readiness for shipment to a smelter.

WEST KOOTENAY.

Ainsworth.—During five weeks ended December 2, ore receipts at Trail from mines in Ainsworth mining division were as follows: No. 1 619 tons, Bluebell 514 tons, Utica 75 tons, Cork-Providence 63 tons, Retallack

& Co. 30 tons, Panama 15 tons, Bon Ton 6 tons: total 1,322 tons.

Slocan.—Silver-lead ore received at Trail from Slocan mines during five weeks ended December 2 totalled 1,278 tons, as follows: Standard 957 tons, Ruth 91 tons, Rambler-Cariboo 89 tons, Slocan Star 44 tons, Lucky Thought 33 tons, Hewitt 31 tons, Black Prince 22 tons, and Black Grouse 11 tons.

Shipments of zinc ore and concentrate during November have been given by the Nelson Daily News as having reached a total of 1,702 tons. The quantities from the several mines and mills were: From the Standard 1,109 tons, Lucky Jim 364 tons, Surprise 120 tons, Ruth 44 tons, Whitewater 35 tons, and Galena Farm 30 tons. The Galena Farm is a new shipper, the mine having been inoperative for years; the Ruth has resumed shipment of zinc concentrate after a somewhat long period of inactivity at its concentrating mill while the further development of the mine was in progress.

Nelson.—The Gold King group of five mineral claims, situated on Hall creek, two and a half miles from Hall siding on the Nelson-Spokane railway and 15 miles from Nelson, is being developed by Mr. W. S. Hawley and associates, of Spokane, Washington. The property is in the neighborhood of the old Fern gold mine which in past years was one of the producing mines of Nelson mining division. The first work undertaken by this Spokane syndicate included the construction of 2,000 ft. of road to connect with the Government wagon road to Nelson. A vein containing from 16 to 30 in. of ore of good average grade has been opened in places along a distance of about 1,000 ft., beside which open cut work an adit has been driven and a prospect shaft sunk. A steam-operated plant, comprising compressor, hoist, sinking pump, etc., has been put in and machine drills are used in the work of driving and sinking. Mr. W. A. Brockway, from Denver, Colorado, a man with 30 years experience in mining, milling, assaying, etc., is in charge of operations on the ground. The property is reported to be a promising one, and it is expected it will be on the producing list during the ensuing year. Eight men were employed on it last month, and more will be put on as soon as developments shall warrant an increase in numbers.

Trail and Rossland.—The total quantity of ore received at the Consolidated Mining and Smelting Co.'s smelter at Trail during 48 weeks of 1915 ended December 2 was 411,784 tons, an average of 8,579 tons a week throughout the period mentioned. These figures compare with a total of 364,809 tons, an average of 7,600 tons a week, for the corresponding period of 1914. The total for the whole of 1914 was 395,935 tons, so if the general average of this year be maintained for the remaining four weeks to its close, the increase in receipts in 1915 over 1914 will be approximately 50,000 tons. It is noteworthy that of this year's total of 411,784 tons for the expired period above-mentioned, the proportion from Rossland mine was 314,101 tons, or 76 per cent. of the whole.

The Daily Colonist, of Victoria, on December 15, quoted Mr. Lorne A. Campbell, representative in the Legislative Assembly of British Columbia for the Rossland constituency, as having said in the course of an interview: "It is no mere figure of speech to declare that a new era is opening—in fact, has opened—to the

mining industry of British Columbia. Evidence of this may be found at Trail to-day, for there the Consolidated Mining and Smelting Co. is making important additions to its reduction works. Provision is being made for the treatment of zinc-lead ores, and this is involving an expenditure of more than \$1,000,000. Large buildings have been erected and much modern machinery installed, and it is expected the new plant will be in running order by January 15, next. When it is remembered that these extensions were not undertaken until last September, an idea will be obtained of the expedition that has been shown by the management of the company to provide ore-reduction facilities to meet the changed conditions; a situation that, I am convinced, is more promising for the mining industry of the province than ever before in its history."

Concerning mining activities, Mr. Campbell said: "The mines in Kootenay and Boundary districts are working to their capacity. Rossland mines are making a production of about 1,000 tons of ore a day, while those of the Granby Co., in Boundary district are sending to that company's smelting works at Grand Forks more than three times that quantity daily. The town of Rossland is experiencing a return of prosperity like that of the old days; but it is prosperity that is founded on a solid basis. The entire community is benefiting from the profitable operation of the mines."

GENERAL NOTES.

A promising feature in connection with the opening of mining properties in Portland Canal mining division is that several of the mineral claim-owners have sent to the smelting works carload shipments of ore. The fact that these men have sufficient confidence in their respective properties to induce them to spend time and money in making occasional shipments of ore in bulk impresses favorably prospective buyers of mineral claims and so improves the chances of selling the property.

Efforts are being made to interest United States men in the Indian Chief group of claims, on Sydney inlet, west coast of Vancouver island. Some years ago this property was worked for a time by the Tyee Copper Co. under option of purchase, but under then existing conditions developments did not warrant the company's taking up its option. It is reported that ore from the property is being tested by a flotation process; if results shall be as favorable as expected the position will be a changed one, and the outlook for profitable utilization of the ore be much improved.

SILVER PRICES.

December—	New York. cents.	London. pence.
9.	56	26 $\frac{7}{8}$
10.	55 $\frac{3}{4}$	26 $\frac{3}{4}$
11.	56	26 $\frac{7}{8}$
13.	56	26 $\frac{7}{8}$
14.	55 $\frac{5}{8}$	26 $\frac{1}{2}$
15.	55	26 $\frac{3}{8}$
16.	54 $\frac{1}{2}$	25 $\frac{1}{2}$
17.	54 $\frac{1}{2}$	25 $\frac{1}{2}$
18.	54 $\frac{1}{4}$	26
20.	54 $\frac{3}{8}$	26 $\frac{1}{8}$
21.	54 $\frac{3}{8}$	26 $\frac{1}{8}$
22.	54 $\frac{1}{2}$	25 $\frac{1}{2}$

MARKETS

STOCK QUOTATIONS.

(Courtesy J. P. Bickell & Co., Standard Bank Bldg., Toronto.)

As of close of Dec. 22, 1915.

New York Curb.

	Bid.	Asked.
Atlanta.	.21	.22
Canada Copper	2.00	2.06¼
Belmont.	4.31¼	4.48¾
Braden.	16.12½	16.25
Goldfields Cons.	1.00	1.06¼
Jim Butler	1.00	1.03½
Jumbo Extension	1.18¾	1.25
Standard Silver-Lead (B.C.)	1.87½	1.93¾
Stewart Mining	.56¼	.68¾
Tonopah Extension	3.87½	4.00
Tonopah Merger	.54	.58
Tonopah Mining	6.87½	7.12½
Victoria Oil	2.62½	2.87½
West End Cons.	.74	.77
Anglo American Oil	17.50	18.25
Submarine Corp.	54.75	55.00
Kennecott Copper	53.25	53.50
Maxim Munitions	13.50	13.82½
Int. Marine	17.75	18.00
do. pref.	74.75	75.25
Standard Oil of N. Y.	230.00	232.00
Standard Oil of N. J.	554.00	556.00
Standard Oil (old)	1730.00	....
Standard Oil (subs)	1175.00	....

Porcupine Stocks.

	Bid.	Asked.
Apex.	.07¼	.07½
Dome Consolidated	.18½	....
Dome Extension	.36½	.37
Dome Lake	.26	.27
Dome Mines	28.25	28.50
Eldorado. . . . .	....	.25
Foley O'Brien	.56	....
Gold Reef	.01½	.02
Hollinger.	27.75	28.00
Homestakes	.25	....
Jupiter.	.18¼	.18½
McIntyre.	1.01	1.02
McIntyre Extension	.28¾	.30
Moneta.	.11½	.12
Porcupine Crown	.88	.91
Porcupine Imperial	.04½	.04¾
Porcupine Reserve	.01¾	.02
Porcupine Vipond	.64	.66
Preston East Dome	.06½	.06¾
Teck Hughes	.14	....
West Dome	.15	.15¾

Cobalt Stocks.

	Bid.	Asked.
Adanac.	.25	.30
Bailey.	.05	.05¼
Beaver.	.40	.42
Buffalo. . . . .	....	1.05
Chambers Ferland	.31½	.32½
Crown Reserve	.57	.60
Foster.	.07	.08
Gifford.	.02½	.03½
Gould. . . . .	....	.00½
Great Northern	.04	.05
Hargraves.	.03¾	.04½
Hudson Bay	23.00	....
Kerr Lake	4.35	4.75
La Rose	.65	.75
McKinley.	.51	.56

Nipissing.	7.65	8.00
Ophir. . . . .	....	.08½
Peterson Lake	.36	.36½
Right of Way	.05	.05½
Seneca Superior	.60	.68
Shamrock Cons.	.18	.18¼
Silver Leaf	.02¾	.03½
Temiskaming.	.59	.60
Trethewey. . . . .	....	.19
York Ontario	.01¾	.02
Wettlaufer.	.08	.10

NEW YORK MARKETS.

Dec. 22, 1915—Connellsville Coke—

Furnace, prompt, \$3.25 to \$3.50 per ton.

First half, \$2.35 to \$2.50; Year 1916, \$2.25 to \$2.35 per ton.

Foundry, prompt, \$3.50 to \$4.00 per ton.

Contract, \$3.00 to \$3.25 per ton.

Dec. 22, 1915—Straits Tin (f.o.b.), nominal, 39.00 cents.

Copper—

Prime Lake, 20.37½ to 20.62½ cents.

Electrolytic, 20.37½ to 20.62½ cents.

Casting, 19.62½ to 19.87½ cents.

Lead, Trust price, 5.40 cents.

Lead, outside, 5.40 cents.

Spelter, prompt western shipments, 17.42½ to 17.67½ cts.

Antimony—

English brands, nominal.

Chinese and Japanese, 39.00 to 39.50 cents.

American, 39.00 to 39.50 cents.

Aluminum—

No. 1 Virgin, 98-99 per cent., 54.00 to 56.00 cents.

Pure, 98-99 per cent. remelt, 51.00 to 53.00 cents.

No. 12 alloy, remelt, 43.00 to 45.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, \$130.00.

Platinum—Nominal, \$88.00 to \$100.00.

Cobalt (metallic), \$1.25.

Silver (official), 54¼ cents.

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market, and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 26.00 cents.

Copper wire, base, 21.50 to 22.00 cents.

High Sheet brass, base, 29.00 to 31.00 cents.

Seamless brass tubing, 29.00 to 31.00 cents.

Seamless copper tubing, 29.00 to 31.00 cents.

Braided tubing, 32.00 to 34.00 cents.

Brass wire, 27.00 to 30.00 cents.

Brass rods, 28.00 to 30.00 cents.

Sheet zinc, f.o.b. smelter, 22.00 cents.

TORONTO MARKETS.

Dec. 24, 1915—(Quotations from Canada Metal Co., Toronto)

Spelter, 21 cents per lb.

Lead, 6¾ cents per lb.

Tin, 42 cents per lb.

Antimony, 48 cents per lb.

Copper casting, 22¼ cents per lb.

Electrolytic, 22¾ cents per lb.

Ingot brass, yellow, 13c.; red, 15 cents per lb.

Dec. 24, 1915—(Quotations from Elias Rogers Co., Toronto)

Coal, anthracite, \$8.00 per ton.

Coal, bituminous, \$5.25 per ton.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario Cohen, S. W. Campbell & Deyell. Carter, W. E. H. Ferrier, W. F. Forbes, D. L. H. Gwillim, J. C. Hassan, A. A.	Haultain, H. E. T. Segsworth, Walter E. Smith, Alex H. Smith, Sydney. Maurice W. Summerhayes. Tyrrell, J. B.	Quebec Burchell, Geo. B. Cohen, S. W. DePencier, H. P. Hardman, J. E. Hersey, Milton L. Johnson, W. S. Smith, W. H.	British Columbia Brown & Butters. Fowler, S. S. FOREIGN-New York Canadian Mining & Exploration Co., Ltd. Colvocoresses, Geo. M. Dorr, Jno. V.N. Hassan, A. A.
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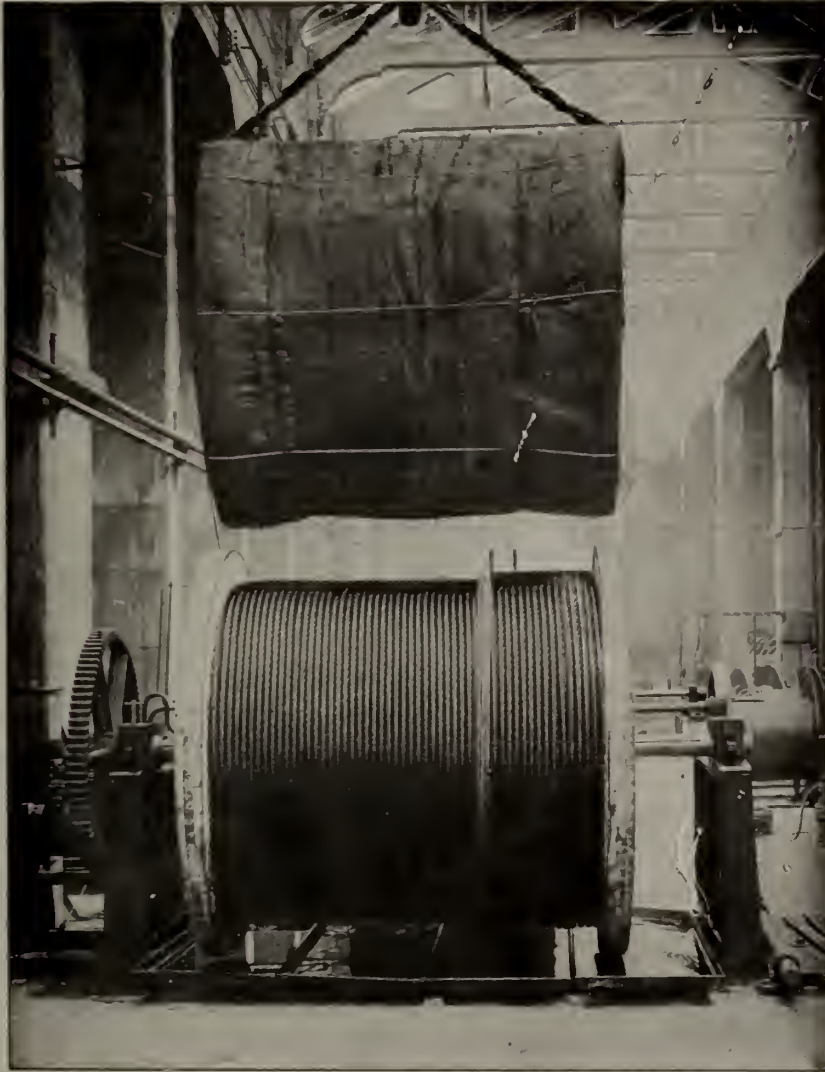
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VOL. XXXVII

TORONTO

No. 2

In This Issue:

Mining in Ontario in 1915

*Coal Mining in British Columbia
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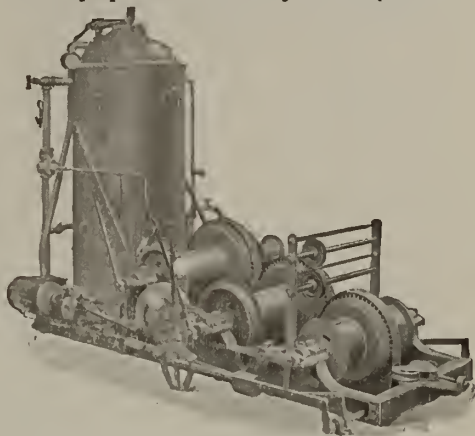
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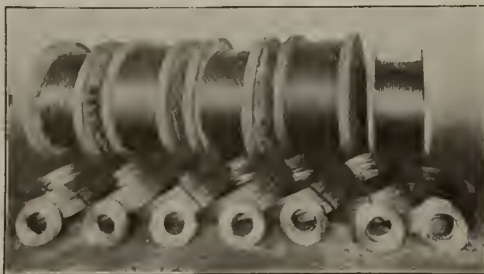
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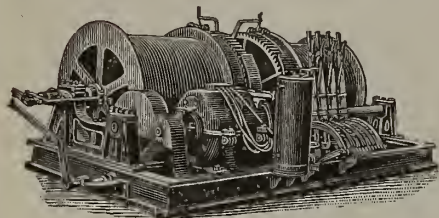
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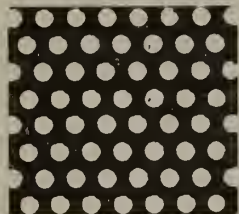
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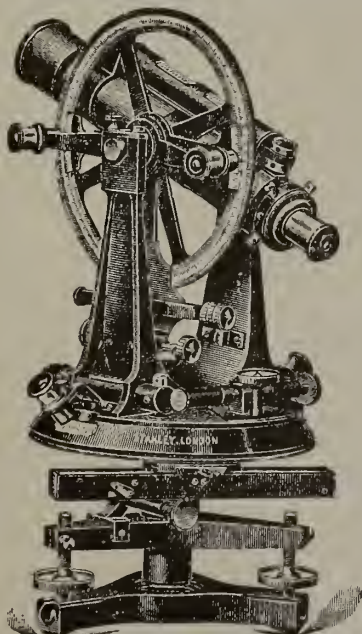
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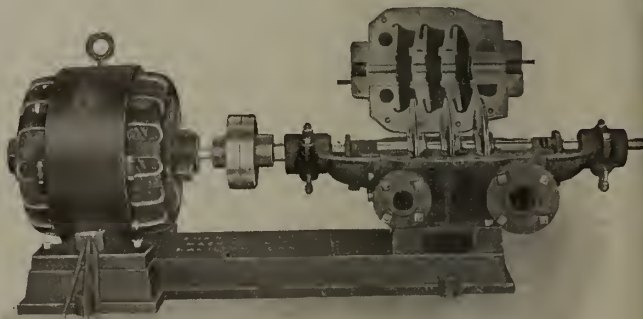
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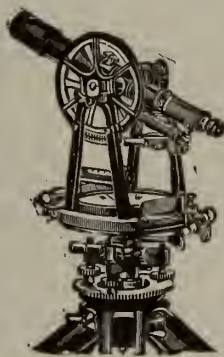
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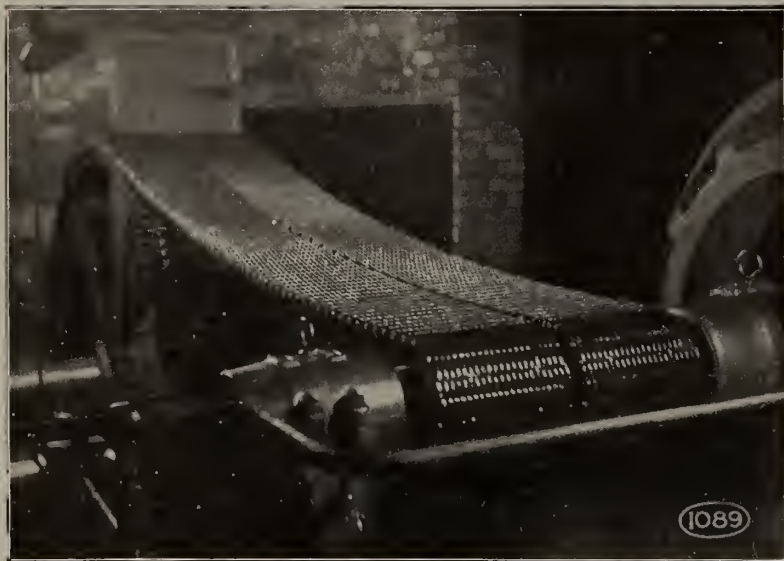
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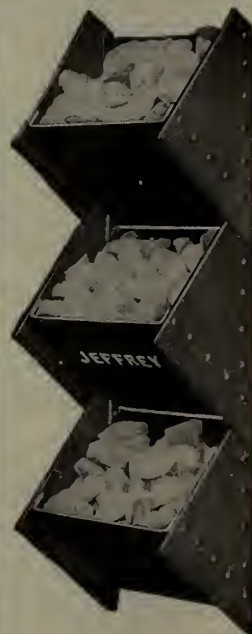
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, January 15, 1916.

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MINING IN CANADA IN 1915

Canada is making new records in mineral production and the outlook for 1916 is very promising. This is a pleasing contrast with the conditions a year ago, when the disorganization of industry which followed the outbreak of war resulted in a severe though brief check to the ever-increasing mineral output of the Dominion.

In Canada, as in other countries the production in the early months of the war was small. Production of most metals might have been increased, but, owing to the general disorganization of business with consequent temporary falling off in demand for mine products, many mines were closed and many others operated at half capacity. The demand for war munitions during 1915 and the increase in general business in the latter part of 1915 created an unprecedented market for most metals.

The year 1915, in spite of the low output in the early months, shows an increase in production of metals in Canada. Non-metals are, as a rule, not in as great demand as before the war.

Ontario for 1915 shows a greatly increased output of gold, nickel and copper, and a substantial decrease in silver. The estimated value of the production for 1915 is: Gold, \$8,000,000; silver, \$10,750,000; nickel, \$7,200,000, and copper, \$2,700,000. The output of nickel-copper matte is being very greatly increased and it is expected that the December output will be over 7,000 tons matte. The iron ore production will be slightly greater than in 1914, but the Moose Mountain mine has been closed down. Petroleum output is less than in 1914, but natural gas production is larger. Structural materials are not in as good demand as in 1914. Pyrite shipments have increased. The operation of a graphite property in Eastern Ontario has been successfully begun during the year.

Alberta coal production in 1915 will show a decrease of about 500,000 tons, being estimated at 3,250,000 tons as compared with 3,743,672 tons for 1914. In the last quarter of 1915 conditions are much improved and output is being increased.

Quebec in 1915 shows an increase in production of metals and decrease in non-metals. The latter make up a very large part of Quebec's output and consequently the total production shows a considerable falling off as compared with 1914. After a period of dullness the asbestos market has improved greatly and the latter part of 1915 has seen a return to normal conditions in the asbestos district.

The great demand for chromite resulted in operations being resumed at several chromite properties in the Coleraine-Black Lake region. Copper and pyrite

production has been increased. A new mill is being erected to replace the Eustis mill which was burned in August. Lead-zinc deposits at Notre Dame des Anges are being successfully worked. Four companies are operating magnesite properties.

The production of British Columbia in 1915 will be about \$30,375,000. This is an increase over 1914 though less than that of 1913, the record year. A great increase in production of copper has helped to swell the total. The value of the chief products is estimated as follows: Placer gold, \$680,000; lode gold, \$5,481,000; silver, \$1,812,000; lead, \$1,756,500; copper, \$9,978,500; zinc, \$1,395,000; coal, \$5,782,000; coke, \$1,490,500; miscellaneous, \$2,000,000.

Nova Scotia's chief mineral product is coal. The production for 1915 is estimated at 6,600,000 tons, or practically the same as that of 1914. The output in the last quarter of 1915 was considerably larger than for the corresponding period of 1914. The coaling of ocean ships has become quite a feature of the Nova Scotia coal trade.

In the Yukon gold production during 1915 was about \$4,750,000, a slight increase over that of 1914. The first machine for use on the Treadgold properties arrived during the year and will probably be in operation during 1916.

EDUCATION IN MINING

In a letter published in the January bulletin of the Canadian Mining Institute Mr. John A. Dresser makes some very interesting comments on education in mining. He says: "The highway to efficiency is education. The means of education vary widely in kind and degree, and man's time and ability to learn are inevitably limited. Consequently our methods of education in mining and metallurgy as well as in every other profession call for careful thought and closest scrutiny."

We should not be satisfied with our present methods of education. It is in the best interests of the mining industry to improve methods of preparing the young men who elect to make mining their profession. Every contribution to the discussion will help those who are responsible for the teaching of mining students.

It should be borne in mind that mining in Canada is increasing at a rate which is much greater than is generally appreciated. The public learns, for instance, that the Cobalt silver mining companies have passed their zenith as profit makers and jumps to the conclusion that mining is on the wane. As a matter of fact not only is production in other districts being increased, but in such districts as Cobalt there are many mining and metallurgical problems which will for years continue to make demands on the best technical talent available. The fact that lower grade ore must be treated in succeeding years means that profits will be smaller and that the necessity for efficiency will be more acute.

Mr. Dresser inclines to the belief that the number of students in mining will fluctuate with the demand for

graduates. No doubt it will, but it fluctuates in a way that those who are connected with mining colleges find it difficult to understand. At present there is a demand for mining graduates that Canadian colleges will scarcely be able to meet. Young men should be encouraged to enter the profession. But those who are engaged in mining owe it to these young men to use their efforts to make the years of preparation as profitable as possible.

At the meeting of the Canadian Mining Institute in March there will be, according to the January bulletin, consideration of the subject of mining education. It is to be hoped that those in charge of mining operations as well as those engaged in teaching will voice their opinions.

The price of silver is holding well around 56 cents and the prospects for larger profits in 1916 than in 1915 are very good. During a year of low prices the Cobalt district suffered considerably. However, most of the mines continued to yield large profits. The margin of profit was considerably lower during 1915 than in any previous year, and it was found advisable in some cases to restrict production, not because it was not profitable, but because larger profits from higher prices were expected to be available later. In some cases production was necessarily restricted owing to decrease in ore reserves. It is not to be expected that all the mines will make large production in the future, for a large part of the high grade ore has been worked out. There is still a lot of silver in the Cobalt district, however, and with higher prices available it may be expected that renewed activity will result. Already several old properties are being reopened.

There is a great deal of interest being shown in oil flotation methods in mining districts throughout Canada and the United States. Many Canadian metallurgists are experimenting. It will not be surprising if methods are devised for profitably treating the sand and slime piles at Cobalt which contain four to eight ounces of silver per ton and which might conceivably be treated at a cost of 50 cents per ton. That is perhaps too much to hope for; but it is a figure that has been suggested by one who has done a great deal of experimenting on Cobalt ores.

The Mond Nickel Company has carried out a number of experiments on flotation of nickel-copper ores and it is not improbable that the Sudbury district ores will be further tested. The results obtained so far are, however, not available for publication.

Hollinger made a new record in the four weeks ending Dec. 2, making a gross profit of \$210,588.52 on 29,448 tons ore treated. During 1915 the company distributed \$1,560,000 in dividends and spent about \$300,000 on additions to plant; but is nevertheless able to report an increase in surplus.

ELECTROLYTIC REFINING OF ZINC

Notable progress in the metallurgy of zinc was made in 1915, and a number of plants designed for the treatment of zinc ores by leaching and electrolysis have been installed. Canadian companies are taking a prominent part in the development of the processes and three of the plants now in operation are in Canada. The Weedon Mining Company, which is operating a lead-zinc mine at Notre Dame des Anges, Quebec, has put into operation at Welland, Ont., a plant in which the Watts process is used. At Trail, B.C., the Consolidated Mining and Smelting Company of Canada has carried on much experimental work on electrolytic refining of zinc, and has produced spelter from Sullivan mine ore at the rate of 1,000 pounds per day. The results obtained were considered promising enough to warrant the construction of a larger plant. There is now being erected at Trail a plant designed for an output of twenty-five to thirty-five tons per day. At Silverton, B.C., the Standard Silver Lead Mining Company is using the French process of electrolytic production of zinc.

In view of these developments an article published in the January 1st issue of *Metallurgical and Chemical Engineering* is of special interest. The authors, D. A. Lyon, O. C. Ralston and J. F. Cullen, of the Department of Metallurgical Research, University of Utah, say:

"When the European war started there were three electrolytic zinc plants in Europe supposed to be operating on a commercial scale. All of these were on a small scale, and were producing zinc from by-products. At Winnington, Northwich, Cheshire, England, was the plant of Brunner, Mond & Co., which is an alkali works and which has been disposing of calcium chloride solution wastes by leaching zinc ores with them (with simultaneous action of carbon dioxide). This gave a zinc chloride solution from which the zinc was recovered by electrolysis, giving a spelter containing 99.96 per cent Zn., and producing chlorine gas which was absorbed to make bleaching powder. This process is one of those originally designed by Hoepfner, and was experimented on during the 90's in Germany, resulting in the installation of a like plant at Duisburg, Germany. Both of these plants have kept secret the exact details of the process by which they have been able to get good zinc deposits as their pure spelter has been for years at a premium of at least 1 cent above the ordinary market price. In 1914, a plant was built for treatment of zinc carbonate ores at Kristiania, Norway, under the direction of Borchgrevink, and another at Balestrand, Sogn, Norway, under the direction of E. A. Ashcroft, to treat flotation concentrates from Broken Hill. So far as we know, nothing has been heard of these plants since the war began.

"In the United States and Canada, however, a great deal of experimental work has been done on the leaching of zinc from ores with its subsequent electrolysis. Nearly all of this work has been sulphuric acid leaching followed by the electrolysis of the zinc sulphate solution. While all the various plants have this much in common, the details of the work vary at most of them by almost as many methods as there are plants.

"The Anaconda Copper Co. perhaps has gotten farther along with this work than have most of the other companies. They now have a 25-ton plant near-

ing completion. By a 25-ton plant is meant one that will produce 25 tons of metallic zinc per day. The Anaconda metallurgists regard this as only an experimental plant. Some splendid work has been done at Anaconda in their research work in connection with the development of the process which they are using and the publication of the details of this work by Mr. Laist and his associates will be keenly awaited by those interested in this line of work.

"As to the general outline of the processes employed at the various plants at Trail, B.C., and at Anaconda, the electrolytic liquor containing sulphuric acid, regenerated by electrolysis with insoluble anodes, is used for leaching the ore. The ore is a roasted complex sulphide of lead and zinc carrying silver, some gold (and some copper in the case of Anaconda). By the use of barely sufficient acid to dissolve the zinc, it is possible to get a solution of zinc sulphate carrying low amounts of the other constituents of the ore. This solution must be cleaned by the use of zinc oxide, lime or other cleaning agents, and is then electrolyzed. At most of the plants, lead anodes are used in the electrolytic tanks in order to regenerate sulphuric acid. The process as thus outlined is old, but the refinement of detail has been the feature of nearly every plant attempting to use it.

"At Murray, Utah, and Omaha, Neb., are small plants recovering zinc electrolytically. The one at Murray is following the practice as developed at Anaconda, with variations made necessary by local conditions. It is only an experimental plant and it is expected to produce about 2 tons of zinc per day. The Omaha plant is working on zinc oxide material from the refining of argentiferous lead by the Divine process, and is also in the nature of an experiment.

"Perhaps the most extensive research work on the leaching and electrical precipitation of zinc has been carried out on the ores of the Bully Hill mine, Shasta county, California. The process for the Bully Hill ore was worked out on the assumption that a good deposit of zinc cannot be obtained from a solution containing much sulphuric acid and the effort has been to neutralize the acid as fast as it is formed at the lead anodes. In treating the Bully Hill ore, lime is used to precipitate zinc hydroxide and calcium sulphate from the solution of the zinc sulphate. This precipitate is suspended in the zinc sulphate liquor of the electrolytic cell and as fast as sulphuric acid forms it is neutralized by the zinc hydrate.

"The Reed Zinc Co., whose plant is at Palo Alto, Cal., has operated on the bag house dust from the Kennett smelter of the U. S. Smelting, Refining and Mining Co. This is also an experimental plant designed to produce about a ton of zinc per day. Instead of a solid lead anode they use a sponge lead anode resembling the electrode used in a storage cell. As fast as sulphuric acid is formed at this anode it combines with the lead, forming lead sulphate. This lead sulphate can later be used to give up the acid by reversing the current, after placing the electrode in a sulphuric acid solution. The solution for electrolysis is prepared by dissolving zinc sulphate crystallized from the leaching liquor.

"At Silverton, B.C., the Standard Silver Lead Mining Co. is also experimenting with the production of electrolytic zinc by the French process. French was probably the first man to use manganese in the electrolysis of zinc sulphate solutions, although its beneficial effect has been noticed by other investigators. He found that it deposits as dioxide on the anode and can

be redissolved in sulphuric acid and used over again. He operates his process with considerable of the manganese sulphate in his electrolyte, and instead of using sulphuric acid for leaching, uses a solution of by-product sodium bisulphate.

"At Welland, Ontario, the Weedon Mining Co. is also said to be meeting with success in operating the Watts process. This process proposes the use of a solution of zinc sulphate for an electrolyte in electrolysis, the depolarization of the anode and the prevention of the formation of sulphuric acid by the use of any solid compound of zinc which does not contain objectionable impurities, such as zinc oxide, or blue powder. The fundamental idea of this process is the same as has been worked out in the treatment of the Bully Hill ore. It is also brought out in the recent patents of O. Best, of Oakland, Cal.

"At Mt. Read on the west coast of Tasmania, it has been reported that the Tasmanian Metals Extraction Co. erected a plant for the treatment of zinc-bearing ores, producing a concentrate of zinc oxide. Nothing of the details of the process has been given out, but the zinc is doubtless precipitated from solution by a solution of some alkali, and the resulting hydrate calcined to oxide."

The rapid advancement now being made in the hydrometallurgy of zinc is in no small measure due to the war. There is at present an unusual demand for a high grade product and the price of all grades of spelter is high. There has seldom been a better opportunity to try out the electrolytic method. While it is not unlikely that experimental work would have been carried on by some of the companies under normal conditions, there would hardly have been the same progress in such a short time, but for the incentive given by war demands.

It seems likely that the electrolytic process will prove so successful that it will be well established and many difficulties overcome before the price of zinc returns to its pre-war level. It seems reasonable to expect the cost of treatment to be so much lowered that the problem of treating our troublesome zinc ores will have been very considerably minimized. It is a long time since any such advance has been made in the metallurgy of zinc. The owners of zinc deposits in Canada will do well to consider how the activities of metallurgists have increased the value of properties during 1915.

Calumet and Hecla Mining Company on New Year's Day announced a ten per cent. increase in wages to all employees. The big company is making a large output of copper and disposing of it at a good price. As usual under such circumstances the employees are given a share of the profit. The Calumet & Hecla management has a reputation for efficiency and consideration of employees that is second to none. The New Year's present is characteristic of the company.

According to our Cobalt correspondent the Nipissing stopes are now more nearly full of ore than at any time in the history of the company and discoveries of new orebodies at the Meyer shaft and under Cobalt Lake makes the future brighter than for a long time.

At the Dome numerous additions are being made to plant and the mill output is increasing. The December production was 30,120 tons, averaging \$5.34 per ton.

Owing to the war the cost of explosives for mining purposes has been considerably increased. This is of course to be expected. The extraordinary demand has resulted in great advances in the price of raw materials.

There is considerable interest in prospects at Poreupine and it is not unlikely that several claims, now idle, will be developed this year.

The National Graphite Company of Toronto has successfully put into operation its mine and mill in Hastings County. A very good product, comparing favorably with any on the market, is being obtained.

The Sudbury mining district is experiencing the most prosperous period in its history. The insistent demand for nickel and copper has led the producing companies to push production to capacity. This, however, has proven insufficient and important additions to plant are being made and planned. It is evident that the present year will witness an enormous increase in production of nickel and copper matte. Already the output has been increased to an extent not thought possible a few months ago.

Of the leading gold mines at Poreupine, Hollinger produced \$3,000,000, Dome \$1,325,000, Acme \$900,000, McIntyre \$750,000, Poreupine Crown \$600,000, Vipond \$265,000, and Dome Lake \$105,000 in the year 1915. As a gold producing district Poreupine is making an excellent record. The 1916 output is expected to be considerably larger.

The revival of chrome mining in Quebec, concerning which Mr. A. C. Allenson contributed an article in our issue of Sept. 15, has resulted in over 10,000 tons being shipped in the latter half of the year 1915. Twenty-two mines and prospects contributed to this total.

The demand for copper and pyrite has favorably affected the mining industry in Quebec. The Weedon and Eustis mines are making a large production of pyrite.

Good results are being obtained by the Weedon Mining Company in treating complex lead-zinc ores, at Notre Dame des Anges, by oil flotation methods. A commercial concentrate is being made. The concentrate will be roasted at the mine and then shipped to Welland for treatment by the Watts electrolytic process.

In Michigan the wages of copper miners have been gradually raised as the price of copper warranted it, until they are now the highest ever known in the district.

MINING IN ONTARIO IN 1915

Ontario made a good record in 1915, showing very large increase in production of gold, nickel and copper and some increase in lesser metallic products. Against these increases were considerable decrease in silver output and a falling off in demand for structural materials.

Porcupine shows an increase of over \$2,500,000 in gold production. The Hollinger mill was treating 7,034 tons per week in November as against 5,706 tons in January, and making a gross profit of \$46,192 per week as compared with \$37,746. The average value of the ore varies but little from month to month. It began in January at \$11.10 per ton and in November was \$10.34. The total output for the year was about \$3,000,000. The Hollinger, which is paying 4 per cent. dividend every four weeks, or 52 per cent. per annum on its capitalization of \$3,000,000, has a claim to be ranked among the great gold mines of the world. Its veins are numerous and persistent in depth, and some of them are large. A number of new and valuable veins have recently been found in underground exploration. A six-compartment central shaft is being steadily pushed down, and it is intended to operate the adjoining Acome claims, controlled by the same interests, in conjunction with the Hollinger. The Acome ore is treated in the Hollinger mill, but the returns are kept separate. The yield from the Acome for the twelve months was over \$900,000.

During 1915 \$300,000 was spent on increasing plant at the Hollinger and \$1,560,000 was paid in dividends; but, nevertheless, the balance sheet at the end of the year showed an increase in surplus.

Further increase in milling capacity is under consideration. The metallurgy at the Hollinger mill has not been changed; it is still making use of the modified system of counter-current decantation, together with filtration of part of the residue. Stamp crushing has always been considered satisfactory at the Hollinger, and no change has been made in it.

The Dome mine also shows an improved position as compared with the beginning of the year. Exploration at the fourth and fifth levels has revealed the existence of much better ore than the mixed material on which the mill operated in 1914, and in consequence the average contents have risen in value from \$4.25 per ton to \$5.50. At this rate the production of the Dome in 1916 should be nearly equal to that of the Hollinger. In 1915 the gross return was about \$1,325,000. Opened on a mass of quartz that showed remarkable value in spots, the Dome speedily took on the character of a low-grade mine. The richer ore, resembling that of the original Dome, has materially improved the Dome's prospects. The mill is being enlarged and is expected to be in shape next March to treat about 55,000 tons of ore per month.

No change in the metallurgy is under consideration, the system continuing to be stamp crushing, regrinding in tube mills and separate treatment of sand and slime.

McIntyre-Porcupine Mines, Ltd., produced about \$750,000 in 1915. This company has greatly enlarged its sphere of operations by securing control of adjoining property, formerly held by the Jupiter and Pearl Lake companies. This section of Porcupine will now be developed more energetically and the production

will be much larger when the plans for working the three properties jointly have been carried out.

Porcupine-Crown's operations during 1915 yielded about \$600,000. The Porcupine-Vipond took out about \$265,000, and Dome Lake about \$105,000. The Schumacher mill began to obtain bullion in November. The outlook at Porcupine for the incoming year is undoubtedly good.

Of the other gold mining areas, Kirkland Lake is perhaps the most advanced. Here the new mill at the Tough-Oakes mines began to run shortly after the beginning of the year and has done excellent work. The veins of this mine though narrow are rich, and the ore treated averaged about \$19.00 per ton, some \$450,000 having been obtained altogether.

The Tough-Oakes mill, completed in 1915, is a highly developed cyanide plant for handling rich gold ore. It is referred to by Mr. Herbert A. Megraw in the following terms: "This is probably the most important plant finished and operated during the year. It certainly embodies the results of the most advanced technical study. The Tough-Oakes is a 100-ton all-slime cyanide plant, in which a ball mill replaces stamps. In this case a ball mill of the Hardinge type is installed, the product of which goes to two Dorr classifiers, each operating in closed circuit with a 5 x 20 ft. tube mill. Provision is made for the introduction of copper amalgamating plates should that at any time be considered necessary. The slimes from the Dorr classifiers go to a thickener, the overflow of which is clarified and precipitated. The pulp is sent to Dorr agitators and a series of continuous counter-current thickeners. Transfers of thickened pulp are effected by diaphragm pumps. From the final tank the thickened pulp is discharged by a spigot into a launder, whence it runs through a mechanical-sampling device and then to waste. It will be noticed that in this plant the newest developments of cyanide metallurgy are incorporated. The elimination of stamps from the metallurgical lay-out is a feature that is becoming increasingly frequent during the last few years, and one that will probably become the rule in the future. Continuous pulp-flow and automatic transfer of pulp in solution is another feature of the mill. The elimination of the slime filter for the tailings is a feature of importance. The mill design was under charge of the Butters-Johnston Engineering Syndicate."

Of other properties at Kirkland Lake, the Teck-Hughes has been acquired by Buffalo Mines, Limited, and the latter is building a large mill for treating the ore. Beaver Consolidated is another Cobalt company which has interested itself at Kirkland Lake, having late in the year taken an option on the stock of the Kirkland Lake Gold Mines, one of which company's claims, known as the McKane, adjoins the Teck-Hughes, and is said to carry high values. The Lake Shore is another company engaged in developing promising showings in the same neighborhood.

Several other districts have contributed to Ontario's gold production in 1915. The Canadian Exploration Co., at Long lake, near Sudbury, won about \$260,000. In Munro township, quartz of phenomenal value was found in the Dobie-Leyson claim, now known as the Croesus mine. From 800 pounds of rock \$40,000 in gold was recovered by hand, and in a shaft 125 feet deep, with a little drifting and crosscutting, it is re-

ported that a million dollars' worth of gold has been put into sight.

The year was more than ordinarily prolific in promising discoveries. In Boston township, J. K. Papassimakes is developing a claim which shows in places a free distribution of fine gold in dark greenish quartz, and in Pacaud, the next township to the south, Miller and Connell have acquired the McDonough claim, one of the best looking finds of the year. This is a quartz vein a foot wide and about 2,000 feet long, showing free gold wherever uncovered. At Kowkash, 300 miles west of Cochrane, on the National Transcontinental Railway, a spectacular find of gold in quartz was made in August by E. King Dodds, but on sinking, the values disappeared. South of Dryden, on the Canadian Pacific, near Lake Wabigoon, a narrow and irregular vein showing abundance of free gold was located by E. G. Rognon. These veins no doubt will all be opened up in the near future. Meantime the year closed with a decidedly optimistic feeling so far as gold mining is concerned.

Silver production in Ontario in 1915 was smaller than in 1914. The decrease amounted to approximately \$2,000,000, the product having a value of about \$10,750,000 as against \$12,795,214 in 1914. In other words for every six dollars won in 1914, the mines last year won five. Part of the decrease is due to the low prices which prevailed for silver from January until November, when a sudden and decided increase took place, amounting to 8 or 9 cents per ounce. This had the effect of stimulating production and development, and the year ends at Cobalt with a much improved outlook as compared with a year ago. The leading mine at Cobalt is still the Nipissing, the Mining Corporation of Canada coming next, and Coniagas, Kerr Lake, Seneca-Superior, Temiskaming, Beaver, McKinley-Darragh-Savage, O'Brien and LaRose following. The finding of new veins continues to reward exploration, both above and below ground. At the Townsite mine a system of high grade veins has yielded much rich ore. Deep drilling is in progress at the Beaver mine in the hope of eventually encountering good ore at the lower contact of the diabase sill and the Keewatin. Most of the silver produced from the mines is now refined in the Province; much of it at the mines themselves and the remainder by the refineries at Deloro and Thorold. The sale of cobalt and nickel oxides has almost ceased since the war began, but the refineries are beginning to produce both metallic cobalt and metallic nickel.

Taken together, the value of the gold and silver obtained in Ontario in 1915 exceeded that obtained in 1914, but while the production of gold is going up, that of silver is going down. The famous mines of Cobalt have passed their zenith, and their yield is decreasing. Production was stimulated by the sudden and decided rise in the price of silver in November. By-products of the Cobalt ores, particularly cobalt oxide and nickel oxide, had a poor year, the continental markets in Europe being cut off by the war. In consequence, stocks of these substances are accumulating at the refineries.

At Cobalt during 1915 a new slimes plant was built by the Cobalt Reduction Co. This plant was designed to handle the slime from the concentrating mills. It is being successfully operated.

The output of nickel in Ontario in 1915 was the greatest in the history of the Province, and further, the rate of production to-day is much higher than in the early part of 1915. The year's output was about

32,000 tons of nickel. Practically all of this came from the Sudbury district, the Alexo mine near Porcupine and the Cobalt ores contributing a small proportion. The Canadian Copper Co. and the Mond Nickel Co. have been pushing production to the utmost limit of their capacity in the effort to supply the demand for war purposes. Most of the former company's output was from the great Creighton mine, the ore of which carries a high percentage of nickel as compared with the average of the mines in the district. The Mond company draw their ore from a number of openings, including the Garson and Levack, the latter having reached the stage of steady production. The Alexo ore is purchased by the Mond company and smelted at Coniston, and this company has also bought the old Bruce mines for the sake of its siliceous ores which are desirable for smelting mixtures, and which besides carry an appreciable percentage of copper. The final product of the Sudbury plants is the Bessemer matte, containing 75 or 80 per cent. of nickel and copper combined. This is sent to New Jersey by the Copper company and to Wales by the Mond company for final separation of the metals. Values in gold, silver, platinum and palladium are also recovered from these mattes.

The copper production of Ontario increases with the nickel production, the copper occurring with the nickel in the ores of the Sudbury district. The output in 1915 was about 18,750 tons. In addition to the nickel-copper ores there was mined during the year some siliceous copper ore from the old Bruce mines. This is used as a flux at the Coniston smelter. The Mond company purchased the Bruce mines recently.

Although Moose Mountain mine is now closed down, shipments of iron ore during 1915 were somewhat larger than in 1914. Production during the first nine months of 1915 from Helen, Magpie and Moose Mountain mines was valued at \$601,444.

On the other hand, the quantity of pig iron turned out by the blast furnaces of the province fell off materially. Most of the iron ore charged in these furnaces is imported from the United States.

The demand for building materials and clay goods, owing to the stoppage of building operations consequent upon the war, was not good in 1915, and production of these non-metallic substances consequently fell off. Petroleum continues to be pumped in the Lambton field, but in diminishing quantities, the yield in 1915 being not over 7,000,000 gallons. Natural gas, on the other hand, has been obtained in much larger volume during recent years than formerly, and valued at a low figure at the wells, the production in 1915 was worth about \$2,300,000.

Pyrite production was considerably increased during 1915 and the National Graphite Co. put into successful operation its mine and plant in Hastings county. Salt production was about as usual. There was a small production of molybdenite and a concentrating plant has been put in operation by the Orillia Molybdenum Co.

While the record of Ontario's mines in 1915 is a very good one, considering the ill effects of the war, the year's record is hardly indicative of present activity. Production during the latter part of the year was much greater than in the early months and was never so great as it is to-day.

The year 1916 will be a busy one at the mines. Increase in production is being planned and numerous additions to plants will be necessary. Several new properties and some old ones are being opened up.

COAL MINING IN BRITISH COLUMBIA IN 1915

By E. Jacobs.

The gross production of coal in British Columbia in 1915, that is including the coal made into coke, was approximately 2,308,000 short tons. It being the official custom of the province, however, to record production in tons of 2,240 lb., it will be more convenient to make comparisons in that measure. The quantity given above is subject to revision when the final returns shall come in, an estimate having been made of the December production in arriving at the total here used as representing the production of 1915. The following table affords opportunity for making comparisons between the totals of output of six successive years:

Gross output in	Tons of 2,240 lb.
1915	2,060,804
1914	2,166,428
1913	2,570,760
1912	3,025,709
1911	2,297,718
1910	3,139,235

The year 1910 was the "record year" of the coal production of British Columbia; since then conditions have been in one way or another unfavorable to a correspondingly large yearly output—large for the province—being made. For eight months of 1911 the Crowsnest District collieries were closed, owing to non-agreement between the operators and the mine-workers relative to wages, etc.; the result, so far as production was concerned, was a decrease of 941,000 tons as compared with the 1910 output of that district. For several months of 1912 there was labor trouble at the mines of the Canadian Collieries (Dunsmuir) Limited, with a resultant decrease in output of coal. In the spring of 1913 the United Mine Workers of America determined to force an issue and so called a strike at all the coal mines on Vancouver Island, so there was a decrease of 616,000 tons in that year's production in the Coast district as compared with that of 1911 when there was not any similar obstacle in the way of production. The reasons for a further decrease in the total output in 1914, as stated in the official "Annual Report of the Minister of Mines" included the following: "The decreased coal output is undoubtedly entirely attributable to the war, not acting directly, but through the allied industries which serve as customers for the colliery products, an illustration of the interlocking of the modern commercial business. In the interior of the province the effect of the war was first felt in the complete demoralization of the metal markets, which are essentially world markets. This led to the immediate shutting down of all the larger copper mines and smelteries, thus removing an important factor in the market for coal and coke. In turn, this reacted upon the volume of freight to be handled by the railways, causing thereby a very great reduction in the consumption of fuel in the locomotives. . . . In the Coast district the war made itself felt through different channels, as there were not any smelteries in operation there, but the activity of German cruisers so affected trans-Pacific shipping as to greatly reduce the quantity of coal used for this purpose. . . . It is claimed that much more coal could have been produced by Vancouver Island collieries had there been a demand for it."

As to 1915, the chief loss in production was in the Crowsnest district, caused in large measure by the Hosmer mines having been closed and by a lessened output from the Corbin colliery, these together showing a decrease of 123,825 tons, against which there was an increase of 18,607 tons from the Crow's Nest Pass Coal Company's mines, leaving a net decrease of 105,218 tons. This company now has some of its mines in such good condition that it could have produced, without difficulty, had there been a market for it, fully twice as much coal as it did. There was a generally reduced output from the relatively small mines of Nicola and Similkameen districts, their total production having been only 101,060 tons as compared with 138,931 tons in 1914. These mines are at a disadvantage in being situated at a comparatively long distance from populous or manufacturing centres. The production of several of the Vancouver Island mines was smaller than in 1914, the Vancouver-Nanaimo Co.'s output having been 61,000 tons less; that of the Canadian Collieries Company's Comox mines 34,000 tons less, and that of the Pacific Coast Coal Mines, Ltd.'s South Wellington mine (which was flooded for several months) nearly 26,000 tons. Against these decreases there was an increase of nearly 101,000 tons from the Western Fuel Co.'s mines, of which 28,000 tons was from its new Reserve Shaft mine; 35,000 tons from the Extension Colliery mines of the Canadian Collieries, Ltd., and 22,500 from the new Morden mine of the Pacific Coast Coal Mines, Ltd. The net result was an increase of about 37,500 tons as compared with the output of 1914, the totals for the two years having been approximately 1,109,800 long tons in 1915 against 1,072,300 tons in 1914.

Production of Coal in British Columbia in 1915.

	Tons of 2,240 lb.
Vancouver Island:	
Canadian Collieries (Dunsmuir) Limited	
Comox Mines (Cumberland)	360,410
Extension Mines	164,365
Western Fuel Co.—	
Nanaimo Mines	382,604
Reserve Shaft Mine	28,866
Pacific Coast Mines, Ltd.—	
South Wellington	105,000
Morden Shaft Mine	22,500
Vancouver-Nanaimo Coal Mining Co.	46,034
	1,109,779
Nicola:	
Middlesboro Collieries	54,500
Inland Coal and Coke Co.	32,820
Pacific Coast Colliery Co. of B. C	1,065
Similkameen:	
Princeton Coal and Land Co.	12,675
Southeast Kootenay:	
Crow's Nest Pass Coal Co.	707,010
Corbin Coal and Coke Co.	52,955

Gross production of coal 2,060,804

Of this coal, about 409,000 tons was made into coke—nearly 360,000 tons at the Crow's Nest Pass Coal Co.'s ovens at Fernie and Michel, Southeast Kootenay, and

the remainder at the Canadian Collieries Company's ovens at Union Bay, Vancouver Island. The quantity of coke made was about 248,000 long tons, of which 239,000 tons was made in the Crow's Nest district and 9,000 tons on Vancouver Island. The ovens at Union Bay had been inoperative for several years until, in 1915, they were again used, this time to supply coke for the Granby Consolidated Company's new smelting works at Anyox, Observatory Inlet.

After deduction of the amount of coal made into coke, the net quantity to be taken into account as part of the mineral production of British Columbia in 1915 is approximately 1,652,000 tons. While there will be some changes made after the final returns for the year shall have been received, it will not be sufficient to considerably affect the total, as here given. The net production of coal in 1914 was 1,810,967 long tons, so that there will be a net decrease for 1915 of about 159,000 long tons. On the other hand, there will be a gain in coke, for against a production of 234,577 long tons in 1914 the estimated quantity for 1915 is 248,424 tons. Shown in money, the difference in value between the production of coal and coke combined in 1914 and 1915 will be \$473,303, the respective totals being \$7,745,847 for 1914 and an estimated total of \$7,272,544 for 1915.

VANCOUVER ISLAND COLLIERIES.

Western Fuel Co.—Of the Vancouver Island coal mines, those of the Western Fuel Co. made a substantial increase in output in 1915 as compared with 1914, their total for 1915 having been 411,470 tons against 310,564 in 1914, a gain of 100,906 tons—72,514 tons from the Nanaimo mines and 28,392 tons from the new mine known as the Reserve Shaft mine. The increase would, doubtless, have been considerably larger but for a disastrous explosion which for some time seriously interfered with production from the Reserve mine. The company's Nanaimo operating mines include the No. 1 or Esplanade Shaft and the Protection Island mine. A brief official description of these mines, which are connected underground, is as follows. "No. 1 mine is situated at the south end of the Esplanade, in the city of Nanaimo, and has been in operation for many years, with good prospects for many years to come. The present operations are at a depth of 600 to 1,200 ft. below the surface, with a large submarine area. This mine has three openings, namely, the main hoisting (No. 1) shaft, Protection and Newcastle Island shafts. These shafts are connected and are part of the Douglas and Newcastle seams, and all are equipped with hoisting apparatus in case of emergency.

"The Newcastle seam is from 3 ft. to 3 ft. 6 in. in thickness, and is of a very hard nature; it is worked on the longwall system, to which it is well adapted. It is 60 to 70 ft. deeper than the thicker Douglas seam which, it is of interest to note, was first opened when, in 1884, No. 1 shaft 17 ft. and No. 2 14 ft. in diameter were sunk to it after a bore-hole, which was put down in 1881, had shown the seam to be at a depth of 650 ft. and to there be 8 ft. 6 in. in thickness. In 1887 No. 2 shaft was deepened and at 71 ft. below the Douglas seam it entered the Newcastle seam, there about 6 ft. thick. It will thus be seen that these Nanaimo mines have been producers of coal for more than 30 years. The Reserve mine is distant from Nanaimo about five miles. The shaft is in the centre of a 2,500-acre virgin coalfield. Sinking was commenced in 1910, and coal was reached, at a depth of 1,043 ft., in April, 1913. Main and auxiliary shafts 350 ft. apart were afterward

connected. The coal, where cut by a rock tunnel from the shaft, showed 14 ft. in thickness of the Douglas seam, the coal being clean, firm, and of good quality. Ventilation of the two shafts was provided for by a pair of 90-in. Sirocco fans connected to a 24 by 30 engine by a rope-drive and standing on substantial concrete foundations 80 ft. distant from the shaft with two concrete tunnels having a total area of about 110 sq. ft. The surface equipment is modern, with tippie and screening plant at the main shaft. The tippie building is a commodious structure, and the handling capacity of the plant is 2,000 tons of coal in nine hours.

Canadian Collieries.—The Canadian Collieries (Dunsmuir) Limited, operates two collieries, namely, Comox and Extension. These collieries were previously owned and operated by the Dunsmuir interests but were acquired in 1911 by the organizers of the Canadian Collieries.

The mines of the Comox colliery are situated in the neighborhood of Cumberland, about 70 miles north of Nanaimo. A standard-gauge railway connects the mines with the seaboard at Union Bay, where there are a coal-washer and a battery of coke-ovens. The mines that have been worked in recent years are Nos. 4 and 7 slopes and Nos. 5, 6 and 8 shafts. There has not been much change since 1913, when electric power was substituted for steam, much new machinery and mine and railway equipment put in, and considerable underground development work done. Before all this preparation for increased production of coal was completed labor troubles were experienced, commencing in the autumn of 1912 and continuing throughout 1913, and these adversely affected the supply of fuel to markets then open. Since these difficulties have been overcome there has not been a sufficiently large demand for coal to admit of the mines being worked anything like full time. The changed conditions are shown by the production figures over a series of five years. For 1911, 1912, and 1913, respectively, the gross output of coal from these mines was 437,335, 475,803, and 508,095 long tons; for 1914 it was 394,731 tons, and the estimate for 1915 places the quantity at 360,410 tons. As compared with 1914, last year's production shows a decrease of 34,321 tons. The successful conclusion of negotiations with the Granby Consolidated Co. for the supply of coke for its smelting works at Anyox, on the Pacific coast, provided means for profitable use of between 45,000 and 50,000 tons of slack. Speaking generally, the plain fact is evident, that there was not a market for anything like the quantity of coal that could have been produced at Cumberland had there been a considerably larger demand for it.

At the company's Extension mines, of which four have been in operation in late years, there was an improvement over the conditions that obtained in 1914, for the increase in output in 1915 was 35,149 tons, which a little more than compensated for the decrease at Cumberland, leaving the net increase from the whole of the company's mines at 828 tons.

Pacific Coast Coal Mines, Ltd.—The flooding of this company's South Wellington mine early in the year, water from a nearby old mine having broken through into it, caused a suspension of output of coal from workings previously productive, the result having been a decrease from South Wellington of 25,645 tons. However, the company's new Morden Shaft mine produced 22,500 tons, so the net loss was only 3,145 tons. The South Wellington mine production figures for the two years were 130,645 long tons in 1914 and 105,000 (estimated) in 1915. In 1911, however, an output of

205,048 tons was made, so this company, like others, has suffered from the unfavorable conditions of quite recent years.

Much progress has been made in developing and equipping the company's Suquash colliery, in the northern part of Vancouver Island.

Vancouver-Nanaimo Coal Mining Co.—This company operates the Jingle Pot mine, New East Wellington colliery, situated about two miles from the city of Nanaimo, working on the coal seam known as the Old Wellington seam. Its production in 1915 was the smallest for five years or more—only 46,034 long tons, against 107,158 tons in 1914. In the official report for 1914 the district inspector of mines reported "no development work is in progress. All places have reached the boundary, and we are coming back extracting pillars." Probably similar conditions are accountable for the decrease in output in 1915.

NICOLA AND SIMILKAMEEN.

Three collieries produced coal in Nicola district in 1915, but there was a decided falling off in the total output, which was only 88,385 tons against 114,546 in 1914. The Middlesboro Colliery produced 54,500 tons, the Inland Coal and Coke Co. 32,820 tons, and the Pacific Coast Colliery Co. 1,065 tons. The corresponding figures for 1914 were 60,705, 53,281, and 560 tons. The net decrease, therefore, was 26,161 tons. Slackness of coal trade and high railway freight charges are held accountable for the non-progressive conditions obtaining here.

In Similkameen district, only the Princeton Coal and Land Co. made any production, and the output from its mine at Princeton was but 12,675 long tons as compared with 19,535 tons in 1914 and 29,206 tons in 1913. There is, however, a decided improvement in the fact that recently another railway was completed and commenced operating, and this gives Princeton coal access to several markets previously practically inaccessible to it, since only long and roundabout railway connections were available, with a correspondingly high freight charge that was really prohibitory. The prospects, therefore, are now believed to be more promising than at any previous time since the company commenced to mine coal.

The Coalmont colliery was closed throughout the year, awaiting money for continuing development and providing machinery and other equipment and transportation facilities between mine and railway. Here again confidence is felt that the outlook is better now that there is a competing railway and more provincial markets accessible.

SOUTHEAST KOOTENAY COLLIERIES.

The closing of the Hosmer colliery in 1914 left but two coal-mining companies operating in this district, namely the Corbin Coal and Coke Co. and the Crow's Nest Pass Coal Co. The loss of production from the Hosmer mines has made a considerable difference in the total output of the district, since the Canadian Pacific Railway Co. does not take from other mines in the British Columbia part of the Crow's Nest district coal to compensate for that it formerly took from the Hosmer colliery. In 1914 the Hosmer mines made an out-

put of 102,468 tons against nil in 1915. A reduced output from the Corbin mines made the decrease larger, and this was only in small degree offset by an increase of 18,607 tons from the Crow's Nest Pass Coal Co.'s mines, so that the net decrease was 105,218 long tons, the district total having been 849,965 tons in 1915 as compared with 955,183 tons in 1914.

Corbin Coal and Coke Co.—This company operated two mines, namely No. 4 mine, situated near the tippie, and No. 3 mine, also known as the "Big Showing," worked both on the surface and underground. At the latter, surface operations are carried on when there is not any snow to impede the work by the open-cut or quarrying system, the coal being loaded by hand into one-ton bottom dump cars which are emptied into railway cars nearby. Output from No. 3 was 24,210 tons, and from No. 4 underground workings 28,745 tons, total 52,955 tons, against 74,312 tons in 1914.

Crow's Nest Pass Coal Co.—This company in 1915 worked eight mines at its Coal Creek colliery and four at its Michel colliery. Coke ovens were operated at both Fernie and Michel. Its gross output of coal was 797,010 tons, against 778,403 tons in 1914, an increase of 18,607 tons. The quantity of coke made was 239,178 tons, as compared with 199,866 tons in 1914, an increase of 39,312 tons, which more than compensated for the loss of production at the Hosmer ovens that in 1914 made 34,711 tons.

Of the eight mines operated at Coal Creek in 1915, that known as No. 1 East, one of four on the south side of the valley, was the largest producer. It is at an elevation of 90 ft. above the central tippie and 800 ft. east of it. It was opened by means of a rock tunnel which ent the coal at 215 ft. from the entry. Both main and counter tunnels were driven 3,500 ft. toward the south. The cost of upkeep of the return airway having been considerable owing to pressure of the upper part of the large seam (the airway had been driven in the lower part of the seam), the timbers were drawn and the top coal to the main roof was dropped. The roof is of hard sandstone, so no timber is required to keep it up; the permanent air-course now provided will cost little to keep it in good order. Late in the year there was installed an endless-rope haulage system, operated by an engine placed outside the mine, to deliver the coal from the inside of the mine to the central tippie.

Much good work has also been done in the company's mines at Michel colliery, which like Coal Creek, now is in shape for production on a much larger scale than in past years, large new coal-areas having been opened. Of the four mines in operation, that known as New No. 8 is most noteworthy. No. 8 seam has been re-developed above old No. 8 workings sealed off on account of fire. Two tunnels have been driven and from these a four-way system of levels is projected, the two lower now well on the way, and Nos. 3 and 4 being developed by the advancement of backway incline raises that are being driven. A three-track tram line connects with a Phillips crossover tippie at the head of a gravity incline down to the endless-haulage system, thence to the main tippie. A pair of counter-balanced 7-ton skips operated from two 8-ft. drums controlled directly from the top loading-station and automatically loading and discharging are capable of handling under active working conditions 300 tons of coal an hour. The extension of coal-producing operations into the large field here entered constitutes one of the most important recent developments at the Michel colliery.

GOLD MINING IN YUKON IN 1915

According to the Dawson Daily News the Yukon Territory has contributed to the outside world approximately \$185,000,000 in virgin gold. This magnificent sum has come chiefly from the placers within fifty miles of Dawson. Other rich creeks within 100 miles of Dawson have furnished the bulk of the remainder, while the remaining portion has come from more distant locations.

The record shows a fluctuating output during the ten years previous to the famous discovery on Bonanza Creek in 1896, a tremendous yearly increase until the banner year of 1900, and a gradual decrease until the lowest ebb was reached in 1907, and then began a continued upward leap due to the installation of hydraulics and giant dredges. Since 1910 the fluctuation has been but slight, and the shipments from Dawson have approximated \$5,000,000 annually. In 1914 the slight shrinkage was accounted for to considerable degree by the breaking down of one of the largest dredges just as it got into the best of pay. The same dredge has been out of commission all of this season, undergoing repairs, and it is not certain when it will resume work, so that it is not aiding in this year's totals. Another dredge which worked most of last year on Bonanza is idle this year. But, notwithstanding the idleness of the two dredges, a splendid showing is being made.

The 1915 production is estimated at \$4,750,000, a slight increase over that of 1914.

"The Yukon Gold Company's dredges have been in some of the richest ground this year that they ever worked, and, as a consequence, the total yield for this season of the Klondike camp is ahead of last year. The Yukon Gold Company worked one virgin claim, No. 21, on Eldorado, this season, from which an enormous sum was taken. The claim was bought in the early days of the camp by John J. Healy, the veteran frontiersman, for the N. A. T. & T. Co., and never was worked, so that when the dredge got to work there this year it found the pay as rich as custard. Representatives of the two companies say nothing of the total clean-up, but rumor has it that the dredge got fully half a million dollars in virgin gold out of the ground.

"Some Eldorado claims yielded much better than that by old methods. Tom Lippy, of Seattle, is said to have cleaned up more than a million and a half from No. 16 Eldorado, and No. 17, which was owned by Jim Hall, was a marvellous producer. Both of these claims, like nearly all the best Eldorado properties, were worked by steam thawing and hoisting methods. The old system required five or six years to work out a claim, whereas the dredges now work out several feet of bed-rock and get therefrom much gold which the miners by the old methods could not get.

"The yield now is slightly lower than a year or two ago. Bonanza and Eldorado are now worked by new methods, to a large extent, and other creeks which have been under preparation for the new methods are expected to begin yielding in another season.

"The Treadgold properties, totaling many miles, on Dominion and Quartz creeks, have been in preparation for several seasons, and the first excavator or machine for working there on the large scale has just

arrived. It is now being hauled to the creek, and is to be set up this fall. Mr. Treadgold is expected to arrive here this fall to see it work. The machine was worked in England as a test before being sent here. Similar excavators are used for other classes of mining on an extensive scale in other parts of the world.

Producing Creeks.—"The gold is extracted from the Klondike river, between Bear and Bonanza creeks, and from Bonanza, Eldorado, Hunker and Gold Run creeks. The largest hydraulics are along Bonanza benches. Milvain is working a dredge on Miller creek. Individual production also comes from Sulphur, which now leads in activity on old time creeks near the city and elsewhere in the territory.

"It has been estimated by some that the placers in the old Klondike district, that is, within fifty miles of Dawson, still contain \$130,000,000 to \$150,000,000. The Treadgold property of Indian river, Dominion creek, Quartz creek, Sulphur and tributaries alone aggregating 75 miles or more, have been estimated in the company's prospectus to contain fully 300,000,000 cubic yards carrying 30 cents to the yard, or \$90,000,000. It was stated some time ago that eight miles of gravel between Bear and Bonanza creeks, on the Klondike, remaining to be worked and carrying gravels worth 22 cents a yard, contain fully \$20,000,000. The Yukon Gold Company's properties remaining in the camp are believed to contain fully that much, if not far more. They include, besides properties on Hunker, Eldorado and Bonanza yet unworked, a large portion of Gold Run. Upper Gold Run, comprising 70 claims, also is practically unworked. Many other creeks in the territory being worked by individuals may yet yield millions.

Possible Dredge Propositions.—"Creeks which have been looked on as possible dredge propositions, but which are yet in the hands of individuals, include Gold Bottom, Allgold, Eureka, Clear, Barlow, Scroggie, Mariposa, Henderson, Barker, Thistle, Britannia, Canadian, Nansen, Livingstone, Big Salmon, some of the Kluane creeks, Hight and several others of the Mayo district and a long mileage on McQuesten, many miles of Forty-mile and tributaries, while below the Yukon boundary are numerous creeks in the gold belt in the Circle district, including Independence, Mammoth, Mastodon, Woodchopper and Coal creeks; the several creeks about Eagle and others out of which individuals have taken much gold.

"If the Treadgold excavator works as estimated it will bring many of the lower grade creeks into the producing zone, which years ago never were dreamed of as being workable at a profit, but which are indicated to contain such pay that were they in a thawed zone would produce multiplied millions even by the old dredge methods. Some predict that ground sluicing and scraping or excavating methods, if not dredging, will yet win their golden treasure and good profits to the operators."

"Scotty" Allan, a well-known driver of racing dogs in Alaska, has returned to America from France, whence he went with about 400 malamutes from Alaska and Labrador, for which the price was \$100 each. Some of the dogs had been winners of long distance races over frozen trails in the Nome region, Alaska. Mr. Allan was in Montreal at the end of December and went thence to Berkley, California, to visit his family before returning to Alaska.

ALLOY STEELS*

By George L. Norris.

Steel can broadly be defined as an alloy of iron and carbon that can be forged and rolled. From expediency and necessities of manufacture, certain impurities beneficial or otherwise are present, but not in sufficient amounts to materially alter the characteristics of the pure alloy of iron and carbon.

Under this definition, steel, or as it is now often referred to, carbon steel, is usually within the following maximum composition: Carbon, 1.50 per cent.; manganese, 1.00 per cent.; silicon, 0.35 per cent.; phosphorus, 0.05 per cent.; sulphur, 0.05 per cent.

An "alloy" steel is steel alloyed with one or more metals, in sufficient amounts to influence or change the characteristics of steel, and still possible of forging or rolling.

The usual steel alloying metals are manganese, silicon, nickel, chromium, tungsten and vanadium. As these metals will all alloy with each other, it is evident that it is possible to obtain a great variety of alloy steels.

Steel containing upwards of 1.50 per cent. manganese is not commonly considered an alloy steel, although this percentage of manganese undoubtedly has some effect on the characteristics of steel. This is due no doubt to the fact that manganese is always present in steel.

The alloy steels are usually divided into two groups: "ternary" steels, with one metal alloyed, and "quaternary" steels, with two metals alloyed. The more complex alloy steels are practically limited to high-speed tool steels.

The general characteristics of alloy steels are high elastic limit and great strength, combined with a high degree of toughness as compared with the carbon steel with which they are alloyed. The strength and hardness can be enormously increased by heat-treatment (quenching and tempering) and still have the steel retain great toughness.

Alloy steels are not as a rule placed in service in the condition as forged or rolled. The forging and rolling temperatures are usually so high that the steel requires heat-treatment to refine the grain and develop the exact combination of strength, hardness and toughness desired. It is frequently necessary to anneal after forging in order to facilitate machining operations. This, of course, necessitates subsequent heat-treatment.

Most of the alloy steels are of medium or low carbon content. The corresponding simple or carbon steels are only slightly or moderately improved in strength by heat-treatment.

The use of alloy steels in cutting tools dates back nearly a hundred years, although it was not until after 1850 or 1860 that alloy steels for this purpose became firmly established.

With the advent of iron clad warships began the struggle for supremacy between projectile and armor plate that has been so fruitful in the development of alloy steels. Chromium, nickel and nickel-chromium steels are largely the result of this struggle.

The publication in 1888 by Hadfield of the results of an extensive research of the alloys of manganese and steel, which resulted in the discovery of a remarkable new alloy steel, marks a period of active investiga-

tion into the effect of other metals on steel. The most important of these were the investigations on nickel steels by James Riley in 1889, which demonstrated that a mild open-hearth steel, such as used for structural, general forging and machinery purposes, when alloyed with 3 to 4 per cent. nickel had considerably higher elastic limit and tensile strength, with practically the same or greater ductility. One of the earliest and most extensive applications of nickel steel was for armor plate. For many years nickel steel was the principal alloy steel in use.

During this same period referred to, Hadfield made investigation of the effects of silicon on steel, and also a very complete study of chromium steels, which for some time had been used in a small way for springs and special forgings, but principally for tools and armor piercing projectiles.

The development of high-speed steel about 1900, making it possible to readily machine heat-treated alloy steels, and the advent of the automobile with its demand for superior steel, have brought about the present extensive use and development of alloy steels.

The automobile industry, with its demand for steel of high strength and durability, has been undoubtedly the most important factor in the development of commercial alloy steels, and the largest consumer. Alloy steels are used extensively for transmission gears and shafting, axles, steering levers and spindles, spring chassis frames, crank shaft, cam shaft, connecting rods, valves, and many other parts of automobiles.

They are also extensively employed in forgings for high-speed engines, marine engines, locomotives, electrical machinery, mining machinery and other mechanical engineering structures.

The use of alloy steels in bridge construction has been limited, but there is undoubtedly a field in long-span bridges for an alloy steel of high strength that can be used in the condition as rolled, preferably, or at most with a simple annealing.

Coincident and having a marked influence on the development of alloy steels, was the discovery of large deposits of vanadium ore in Peru, thus assuring a source of supply at a reasonable cost of this rare metal, which is the most powerful yet discovered for alloying with steel, that is, in small amounts.

The most important of the engineering or structural alloy steels are those containing nickel, chromium and vanadium, singly or in combination. With all these steels it is possible, through heat-treatment, to obtain a tremendous range in strength, in round numbers varying from 100,000 to 250,000 pounds per square inch, depending also, of course, upon the size of the section.

It is not possible nor within the province of this paper to go deeply into the technology of alloy steels, but only to briefly describe the principal alloy steels and their characteristics.

Manganese Steel.—This steel usually contains 10 to 13 per cent. of manganese and approximately 1 per cent. of carbon. It is practically non-magnetic and has a peculiar hardness to which it owes a remarkable resistance to abrasion. It is extremely difficult to machine. It has high strength and toughness, but rela-

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., September 20-25, 1915.

tively low elastic limit. With care it can be forged and rolled. It has found its principal application in castings for crushing and grinding machinery and railroad crossings. Manganese steel has the peculiar property of being toughened and softened by quenching in water, resembling copper in this respect. All manganese steel castings are subjected to this treatment to remove brittleness.

Silicon Steel.—There are two types of silicon steel, one of which has found some application as an engineering steel. This steel, frequently called silico-manganese steel, is generally covered by the following limits of composition: Carbon, 0.45 to 0.65 per cent.; silicon, 1.50 to 2.00 per cent.; manganese, 0.50 to 0.80 per cent.; the manganese is normal, contrary to what is indicated by the name. The principal application of this steel is for automobile springs, and to some extent for gears. It fibres readily through heat-treatment, and is very brittle in the direction at right angles to rolling. It is very sensitive to heat-treatment, and a relatively small variation in annealing temperature after quenching has a strong effect on the results obtained.

The other type of silicon steel contains 3 to 5 per cent. silicon, is low in carbon and manganese and is extensively used for electrical transformer sheets on account of its high permeability and electrical resistance. It is weak and has no structural value.

Nickel Steel.—Nickel alloys with steel in all proportions, but by far the most important nickel steel, from an engineering standpoint, is the low and medium-carbon steel with 3 to 4 per cent. of nickel, commonly known as $3\frac{1}{2}$ per cent. nickel steel. The presence of manganese in nickel steel is very essential, as it has a marked effect on the mechanical properties. The amount of manganese should range from 0.50 to 0.80 per cent. This steel has been extensively used since its introduction in 1889, and is a good all-round engineering and structural steel with considerably higher elastic limit and tensile strength than the corresponding carbon steel, and with practically the same degree of ductility. The low-carbon steel, 0.10 to 0.20 per cent. carbon, is used extensively for case-hardening parts. It case-hardens more readily than carbon steel and gives a harder casing with a strong, tough, fibrous core. A great deal of nickel steel with carbon from 0.20 to 0.35 per cent. has been used in shapes and plates as rolled, and in annealed eye-bars for bridge construction. In this condition, which is not to be recommended for forgings, the following are typical physical properties: Elastic limit, 45,000 to 60,000 lbs. per sq. in.; tensile strength, 80,000 to 100,000 lbs. per sq. in.; elongation in 2 inches, 20 to 15 per cent.; reduction of area, 40 to 25 per cent. Annealed nickel steel forgings have only slight advantage in strength over carbon steel, and consequently are not advantageous either from an engineering standpoint or commercially unless heat-treated. With heat-treatment it gives considerably higher strength than carbon steel, combined with greater ductility or toughness. It does not give as high values as the nickel-chromium and chromium-vanadium steels. Nickel steel rolls and forges readily and machines easily. It develops a very thick, hard scale which is apt to give considerable trouble in drop-forging and is hard on the dies. Nickel steel is also very liable to develop seaminess, especially when made in large heats and cast into large ingots, as is now customary. It requires a larger discard to ensure soundness. The use of nickel steel in forgings, and particularly drop-forgings, is falling off in favor of other alloy steels with greater values.

Chromium Steel.—The use of this steel is confined principally to a few specialties and it is not in general use as an all-round engineering steel. One of the principal uses is for balls and ball races. The great mineralogical hardness obtained by quenching is very desirable for this purpose. The steel for this application contains approximately 1 per cent. each of carbon and chromium.

Chromium steel is also used for stamp-mill shoes, and in combination with soft steel in laminated plates for construction of burglar-proof safes, and in the same combination in bars for jails.

The low- and medium-carbon types, containing 0.80 per cent. or less of chromium, have somewhat higher mechanical properties than the corresponding carbon steel. It is not used to any great extent, other alloy steels being superior, both in static and dynamic strength. Chromium steel is also very liable to crack and check in heat-treatment.

Nickel-Chromium Steel.—The addition of chromium to nickel steel has a marked effect, greatly increasing the strength and resistance to shock and particularly the mineralogical hardness. It is more difficult to forge and heat-treat and harder to machine, and is also liable to the seaminess frequently present in nickel steel. There are three types of this steel, differing both in the percentage of nickel and chromium, and all with low or medium carbon:

	Nickel	Chromium	Carbon
1st.	3.5 p.c.	1.50 p.c.	0.25 to 0.45 p.c.
2nd.	2.0 p.c.	1.00 p.c.	0.10 to 0.45 p.c.
3rd.	1.5 p.c.	0.50 p.c.	0.10 to 0.45 p.c.

The first type is used principally for armor plate and armor-piercing projectiles and came into use about 1895, superseding the nickel plates and chromium projectiles. The other two types were developed by the automobile industry. The second type is largely for automobile forgings. It gives high strength with heat-treatment, has great hardness and good shock and fatigue resisting qualities. The third type is a largely used all-round engineering steel. It is used for automobile forgings and for a variety of miscellaneous drop-forgings and machine parts. It is an excellent case-hardening steel, carbonizing readily. This type is more tractable in working, heat-treating and machining than the other two. It is also somewhat lower in tensile strength.

Vanadium Steel.—The addition of small amounts of vanadium, generally under 0.25 per cent., to simple carbon steel or any of the alloy steels increases very considerably—about 30 per cent. or more—the elastic limit and breaking strength, without materially affecting the ductility. To an even greater extent it increases the resistance to shock and fatigue.

The vanadium steel which has been up to now most generally used is a chromium-vanadium steel of the following typical composition: Carbon, 0.10 to 0.55 per cent.; manganese, 0.50 to 0.80 per cent.; chromium, 0.80 to 1.00 per cent.; vanadium, over 0.15 per cent.

The lower carbon type, 0.10 to 0.20 per cent., is used mainly for case-hardening and is the best steel for this purpose. It carbonizes readily, gives the highest maximum carbon and finest grain. The casing is very strongly coherent to the core, very hard, tough and strong and practically free from any tendency to flake or powder. The core is remarkably strong and tough.

The higher limits of carbon, 0.45 to 0.55 per cent., are extensively used for automobile and locomotive

springs, giving remarkable resiliency and endurance. It is also extensively used for oil-tempered gears.

The range in carbon from 0.35 to 0.45 per cent. is largely employed for crank shafts, locomotive axles, crank pins, connecting rods, hammer piston rods, automobile transmissions and rear axle shafts.

The range from 0.25 to 0.35 per cent. carbon is used for automobile forgings of all kinds and a great variety of miscellaneous work requiring the best combination of static and dynamic strength.

As illustrating the wonderful shock and fatigue enduring qualities of chrome-vanadium steel, drop-hammer piston rods of this material are giving many times the length of service of carbon, nickel and chromium-nickel steel rods.

Vanadium steels have a much wider heat-treatment range than other steels. The desired physical properties can be obtained with a higher draw-back or annealing temperature, which is very advantageous as more completely removing quenching strains, and also as a manufacturing proposition.

Chromium-vanadium steel forges and machines better than nickel-chromium steel, is not as liable to injury in heating for forging, is not so liable to crack or check in heat-treatment and is free from the seamy tendency of steel containing nickel.

Carbon steel with a small percentage of vanadium, from 0.15 to 0.20 per cent., has been used extensively for locomotive frame castings with great success. The failures of these frames from all causes over a period of nearly ten years has been only a fraction of one per cent.

In tool-steel grades, this steel has better cutting qualities, hardens deeper and more uniformly, and has remarkable toughness. In what are termed battering tools, chisels, cutters, dies, etc., it gives several times the length of service of ordinary carbon tool steel.

The handicap of high cost of vanadium has almost disappeared, and simple carbon-vanadium steel in the ordinary forging grades will undoubtedly soon become very widely used as an all-round engineering steel, when a better steel than carbon is required. It is remarkably clean and is as easily worked as carbon steel. It is free from the seaminess and ugly scale of nickel steels and the tendency to check and crack of the chromium steels, particularly nickel-chromium.

Tests of carbon-vanadium steel rails in curves are showing about 20 per cent. less wear than rails with 0.15 to 0.20 per cent. higher carbon, and are also considerably stronger. This difference in wear will doubtless be much greater when the carbon percentage in the vanadium rails is increased to that of the standard rails.

In simple annealed forgings, plain vanadium steel has physical properties well above those specified for heat-treated (quenched and tempered) carbon steel.

This type of vanadium steel has a wider range of quenching temperature than nickel or nickel-chromium steels; and for mechanical properties after heat-treatment is practically on an equality with $3\frac{1}{2}$ per cent. nickel or the low nickel-chromium steels in general use, and apparently has higher fatigue resisting qualities.

While nickel and chromium interfere seriously with the welding quality of steel, vanadium does not, but on the contrary improves this quality. Vanadium steel wire is in common use for autogenous welding.

Tungsten Steel.—This is principally used for magnets for magnetos and to some extent in hack saws and special tool steels. Tungsten is seldom used in

engineering constructional steels, and then usually in combination with chromium.

Complex Alloy Steel.—Practically none of the constructional steels contain three or more alloy metals. The only steel in this class to be considered is what is commonly known as high-speed steel. Robert Mushet developed and patented about 1860 an air-hardening steel that was very much superior to carbon tool steel for machining hard material. Mushet steel, as it was known, had about the following composition: Carbon, 2.00 per cent.; manganese, 1.75 per cent.; silicon, 0.75 per cent.; chromium, 0.40 per cent.; tungsten, 5.50 per cent.

At the Paris Exposition in 1900, the Bethlehem Steel Co. exhibited a new tool steel that took wonderfully heavy cuts at high speeds, the point of the tool heating up to a strong blue color without losing its edge. This steel, which immediately became known as high-speed steel, was the culmination of the research work carried on for many years by Mr. F. W. Taylor and later published in his monograph "The Art of Cutting Metals." The difference between this steel and Mushet steel is apparent from the following typical composition: Carbon, 0.60 per cent.; manganese, 0.20 per cent.; silicon, 0.10 per cent.; chromium, 4.00 per cent.; tungsten, 18.00 per cent. With this steel, cutting speeds of over 90 feet per minute were obtained.

Within three or four years it was found that the addition of vanadium to high-speed steel made it possible to still greatly increase the speed and size of cut. At first only about 0.30 per cent. vanadium was added, but this has been increased until now 1.00 per cent. is practically the standard amount in most high-speed steels, and speeds of 140 feet and upward per minute have been attained.

Lately the addition of cobalt to high-speed steel has been meeting with favor as still further improving the endurance of the steel. The amount of cobalt generally used is 3 to 4 per cent., with no change in the percentage of the other metals—tungsten, chromium and vanadium.

DIVIDENDS PAID IN 1915.

Excluding the Mond and International nickel companies operating in Ontario, Canadian mining companies paying dividends in 1915 included: Beaver, \$120,000; Caribou Cobalt, \$115,000; Coniagas, \$600,000; Crown Reserve, \$141,505; Consolidated Mining and Smelting Co. of Canada, \$464,352; Dome, \$400,000; Granby, \$449,955; Hedley, \$300,000; Hollinger, \$1,560,000; Kerr Lake, \$450,000; La Rose, \$412,122; Le Roi No. 2, \$58,320; McKinley-Darragh-Savage, \$269,723; Mining Corporation of Canada, \$518,750; Nipissing, \$1,200,000; Nova Scotia, \$127,200; Peterson Lake, \$189,000; Poreupine Crown, \$240,000; Rambler, \$35,000; Seneca-Superior, \$335,218; Standard, \$250,000; Temiskaming, \$75,000; Rea Mines, \$12,000, and Tongh-Oakes, \$65,187. Considering that 1915 was a poor year for the silver mining companies, these figures indicate that mining is being very profitably carried on in Canada. They fail to show, however, more than one-half the profits. The two companies operating nickel-copper mines in the Sudbury district made alone profits nearly equal to the total dividends paid by the above mentioned mining companies.

MINING CUPRIFEROUS PYRITES IN QUEBEC*

By J. Austen Bancroft.

In the history of copper mining in the Eastern Townships, the year, 1909, should always be prominent because of the discovery of the McDonald or Weedon mine in Weedon township, Wolfe County. The rusty appearance of quite extensive outcrops of sericite schist had attracted the attention of prospectors for several years, but no work had been done, because of the prevalent belief that only disseminated particles of pyrite were present in the schists. In the autumn of 1908, Mr. John McDonald of Sherbrooke, purchased the property, and during the following winter and spring, sank several pits in the rusty schists. It was not until the latter part of August, 1909, when, abandoning the rock outcrops, he began to excavate in the bottom of a grass-covered depression, elongated in a direction identical with the strike of the schists, that a body of cupriferous pyrite was discovered. Here, a shaft, 8' by 8', penetrated solid ore to a depth of about 25 feet. The property was leased under option to Dr. Pierre de Pierre Ricketts of New York, who later transferred it to the East Canada Smelting Company. According to the agreement of option, this Company paid Mr. McDonald \$100,000 for the property.

The first shipment was made from the Weedon mine on August 2nd, 1910, and during the balance of the year 6,112 tons of ore were sent to market. Since that time the shipments (in tons of 2000 lbs.) from this mine, as compared with the total shipments of cupriferous pyrite from this district have been as follows:—

Year	Total shipments from Eastern Townships	Shipments from Weedon mine
1910.....	24,040	6,112
1911.....	38,554	23,700
1912.....	62,107	33,130
1913.....	87,550	52,000
1914.....	117,778	59,058
	330,029	174,000

Thus during the past five years, the Weedon mine has produced 174,000 tons of the total of 330,029 tons of cupriferous pyrite that have been shipped from the Eastern Townships.

At intervals, from 1911 to 1914, about 1800 tons of copper ore have been shipped from the Ives mine, near Eastman. In 1914, 1600 tons of pyrite, carrying only a trace of copper, were shipped from the deposit near Stratford, six to seven miles from St. Gerard station on the Quebec Central railway. The Eustis mine was the only other property from which ore was exported during this period, so that the amount shipped from the Eustis for the years 1910 to 1914, inclusive, has been about 154,249 tons.

The main ore-body of the Weedon mine is a lenticular mass of cupriferous pyrite with which very small amounts of galena and zinc blende are associated; it has proved to be 570 feet in length with a maximum thickness of 40 to 45 feet, and striking N 37° E, dips 40° to 45° to the southeast. On the average the north-eastern portion of the lens has been found to carry somewhat higher values in copper than the south-western. Three shafts have been successively sunk on the vein to depths of 96, 350, and 470 feet. At first, the ore was taken by teams from the mine to the railway, a distance of 5 miles, at a cost of about 80 cents per ton. In 1912, a Bleichert aerial tramway, 19,500 feet in length, was constructed from the mine to the railway, at a cost of \$1.75 per foot, and the cost of transporting the ore

to the railroad thus has been reduced to 6.7 cents per ton. From January 1st to September 1st, 1914, 50,000 tons of ore was shipped the maximum monthly shipments being those of June and July of 7050 and 7220 tons, respectively. Up to date, the ore has averaged 3.62 per cent. of copper, 40.74 per cent of sulphur, 0.77 per cent. of zinc, a trace of lead, and 0.46 oz. of silver and .01 oz. of gold per ton. The ore shipped has been sold for about \$9.00 a ton, payment being made on the sulphur and copper contents.

At present, the Eustis mine is working at a depth of about 3,900 feet on an average incline of 38°. In 1912, at a depth of 3,450 feet the ore bodies comprised four parallel lenticular veins known as the footwall, the main, the shaft and No. 1 veins. The footwall and shaft veins then carried somewhat better values in copper than the others; but in 1913, the average product of the mine contained slightly less than 2 per cent. of copper. At present, work is progressing at the bottom of the mine, upon two lenticular bodies of ore that average 2 per cent. in copper. The Maximum capacity of the mine equipment is about 200 tons per shift. The concentrating mill, which had a capacity of from about ten to twelve tons of mill feed per hour, and in which an Elmore oil concentrator was installed in 1913, was burned in August 1915. A new mill is in course of construction.

During 1909 to 1914, development work on a small scale, but more or less continuously, progressed at the Suffield mine on lot 3, range XI, Ascot, one of the properties of Mr. A. O. Norton. No ore was shipped during this period and upon the outbreak of war, work was suspended, although they were continuing to keep the water out of the mine. In 1910 and 1911, Mr. Norton also removed the water from the old workings of the Marrington mine on lot 6, range IX, of Ascot, but during this time only three tons of ore were sent to market.

In 1910, the Ascot mine had the water removed from it and some sampling was done for the East Canada Smelting Company, but no ore was shipped. In 1913, this mine was again reopened but soon was again permitted to fill with water.

In 1910, as a result of the interest aroused by the discovery of the Weedon mine, a lenticular deposit of pyrite was discovered on lot 8, range VI, S.W. of Stratford township, where in the years 1910 and 1911, an inclined shaft was sunk to a depth of 45 feet in the north-eastern end of the ore body. Four diamond drill holes were also put down and although several feet in thickness of pyrite were penetrated, the copper content of the ore was disappointing to those holding the property in lease at the time. In the summer and autumn of 1914, this property was leased by P. E. Beaudoin of Thetford Mines. The shaft was extended to a depth of 75 feet and in September, at a depth of about 50 feet, they were commencing to drift towards the southwest. About 1600 tons of pyrite carrying on the average from 45 to 48 per cent of sulphur and a mere trace of copper were shipped to the Grasselli Chemical Company's works at Hamilton, Ontario.

The Galt shaft of the old Ives mine, near Eastman, that had been closed since 1876, was reopened in May, 1911, by Messrs. Cromwell and Parker of Eastman. Since then prospecting work has been carried on more or less continuously. The shaft has been sunk from 100 to 180 feet and at this depth a drift extended for 72 feet to the southwest, along a zone of chlorite schists that for a width of four to five feet are traversed, parallel to their schistosity by veins of chalcopyrite and quartz. Operations ceased a

*From report on Copper Deposits of Eastern Townships, Mines Branch, Quebec, 1915.

few months prior to the outbreak of the war. Six carloads, of about thirty tons each, have been shipped from the mine; five of these yielded an average copper content of nine and a half per cent., while one carload selected from a portion of one of the old dumps carried five per cent in copper.

In the summer of 1912, Mr. Pierre Tetrault, of Montreal, started to erect a concentrating mill at the Huntingdon mine (lot 8, range VIII, Bolton) with the aim of working over some of the old dumps on that property. The building was completed but the machinery has not been installed. In the spring and early summer of 1914, the water was pumped out of the old Nichols shaft down to about 275 feet. At a depth of 180 feet, some prospecting work was done where they found the schist impregnated with small amounts of chalcopyrite and pyrite, and traversed, parallel to the schistosity by narrow stringers of quartz carrying chalcopyrite. Work was suspended on the property a month or more before the outbreak of the war. Mr. Tetrault has purchased the property from the Nichols' Copper Company.

In 1909, water was removed from the old shaft of the Lake Memphremagog mine (lot 28, range IX, Potton) and about 125 feet north of the open cut a new shaft was sunk to a depth of 80 or 90 feet.

In the fall of 1909, an Allis-Chalmers water jacketed furnace with a capacity of 80 tons per day, was erected at the old Acton mine, lot 32, range III, Acton by Mr. P. Tetrault of Montreal. The plan was to smelt portions of the old dumps at these mines, and carry on some custom work. About six hundred tons of cupriferous pyrrhotite were brought from the Lake Memphremagog mine; this pyrrhotite was roasted and then mixed with the copper bearing magnesian limestone of Acton. Fifteen hundred tons of ore, selected by hand-picking the old dumps at the Acton mine, are said to have carried about one and a half per cent. of copper. After a short run, operations were suspended and have not been renewed. It is certain that none of the dumps at the Acton mine will average a half a per cent in copper. At the Acton mine, black shales lie beneath an upper limestone and rest upon a series of massive limestone beds. The copper ore that was taken from this property in the early days came from the upper limestone and the uppermost portions of the shale in the vicinity of their contact with irregular dyke-like intrusions of a now highly altered diabase or closely allied rock. In 1913, in order to determine the possibility of mineralization of the lower limestone, a diamond drill hole was put down at what was considered to be the most favorable locality on the property; but no evidences of mineralization were found. This work was done under the direction of Prof. J. W. Bell of McGill University.

In addition to the above operations, some prospecting for copper has been done on other properties, but without discovering any deposits of economic value. During portions of the summer of 1914 prospecting work was being performed on lot 6, range VI, of Brompton, on lot 22, range V, of Stoke, on some lots in the vicinity of the deposit of pyrite at Stratford, and some diamond drilling was being done on lot 23, range III, Weedon, but no encouraging results were obtained.

Labor.—During the early days of prospecting and mining in the Eastern Townships, labor was cheap. Especially was this true of the period during and immediately after the Civil War (1861-65). At that time a considerable number of men, chiefly deserters from the army, and locally known as "skidaddlers," crossed the border into Canada. It was a good miner that during that period received \$1.00 a day; \$1.25 was a very exceptional wage, and many men considered themselves fortunate if they earned 75 to 80 cents a day.

At present wages are higher. At the Eustis, a miner receives \$1.75 a day. A large proportion of the men are

on contract and some of them earn \$3.00 or more a day. At Weedon, the average daily wage is \$2.60. Much of the development work is done under contract at the following rates:—Drifts, 7 x 4, at \$6.00 per foot; Raises, 6 x 10, at \$4.50 per foot; Winzes, 10 x 5, at \$12.50 per foot, and Shafts, 16 x 6, at \$25.00 per foot. These prices cover all labor and supplies, except drill repairs, compressed air and drill steel. In raising and drifting, the company does the shovelling.

MINE-RESCUE AND FIRST AID TRAINING IN BRITISH COLUMBIA.

The larger coal mines of British Columbia are those situated on Vancouver Island and in the Crow's Nest district of Southeast Kootenay, respectively. Smaller fields are those of Nicola and Similkameen, which are about midway between the two larger fields. In all these coalfields instruction is given to miners and other mine-employees in both mine-rescue and first-aid methods. During 1915 it was manifest that first-aid work had taken a firm hold in the larger fields, for in both there were held first-aid demonstrations and competitions. Further, there was a gratifying increase in the total number of members of classes for instruction held under the auspices of the Canadian Branch of the St. John Ambulance Association, which association is the Ambulance Department of the Grand Priory of the Order of the Hospital of St. John of Jerusalem in England, and is engaged in doing work similar in many respects to that of the Red Cross Society in the United States.

On Vancouver Island first-aid instruction classes have been held at Cumberland (Comox colliery), Nanaimo, South Wellington, and Ladysmith (Extension colliery). There have also been several first-aid public demonstrations, in Comox district, at Nanaimo, and at Ladysmith. At the last-mentioned place there was held in November the first annual competition for the Frost-Cunningham Cup, donated by the mines surgeon, Dr. A. C. Frost, and J. H. Cunningham, superintendent of the Extension colliery. Four teams, each of five men, competed, and the winners were the members of team B, from No. 1 mine, Extension. Similarly, there have been demonstrations of the use of oxygen-breathing mine-rescue apparatus and the pulmotor.

The approximate number of men who attended the first lecture of the St. John Ambulance course of instruction in first-aid in 1915 was 700. While less than one-half of these presented themselves at the final examination at the conclusion of the course, it is satisfactory to note that fully 300 passed and obtained the St. John Ambulance Association's certificate of competency to render first-aid to the injured. These numbers include men connected with metalliferous mines as well. Classes were conducted at 20 different mines in 1915. The total number of mine-rescue proficiency certificates issued to date by the British Columbia Department of Mines is 244. Mine-rescue and first-aid railway cars are maintained by the Canadian Collieries (Dunsmuir) Limited, and the Western Fuel Co., on Vancouver Island. There are Government mine-rescue training stations at Nanaimo, Merritt (Nicola), and Fernie (Crow's Nest). Both Thos. Graham, chief inspector of mines, and Dudley Michel, instructor, are zealous in fostering first-aid and mine-rescue training work in the province.

THE METALLURGY OF CANADIAN COBALT ORES

I. METHOD OF TREATMENT AT THE COBALT PLANT OF THE CANADIAN COPPER CO.

By Ralph W. Bridges

The Cobalt plant of the Canadian Copper Company was situated at Copper Cliff, Ontario, about one half mile south of the large copper nickel smelter. The works were remodelled and designed to smelt and treat ores and concentrates from the Cobalt silver district. The plant was in operation from December, 1905, to February, 1913, during which time more than 40,000,000 ounces of silver, 2,200,000 pounds of cobalt, 1,500,000 pounds of nickel, and 4,500,000 pounds of pure arsenic were produced. Some idea of the richness of the ores treated can be obtained from Table 1. The low grade Crown Reserve ore included in this table was used as a flux.

Treatment:—If the ore was in large lumps it was crushed and then ground in a Krupp ball mill to pass 30 mesh. For sampling about 6% was cut out by a Snider sampler. Sampling was completed by coning and quartering. The first quartering divided the sample into four parts, which were worked down as two independent samples known as No. 1 and No. 2. These samples were reduced by quartering until the final quarters separated by a Jones sampler gave two samples of about 18 pounds, one of which was ground and the other held for reserve. The samples were ground to pass 100 mesh, or until nothing but silver scales remained which were weighed and assayed separately. The sampling work and moisture determination for the 8 cars of ore received in May, 1910, is shown in Table No. 2.

The ore was charged with suitable fluxes into 32" x 72" blast furnaces, having a capacity of 25 to 30 tons per 24 hours. Limestone from Michigan was used as a basic flux and low grade Crown Reserve ore was used as the acid flux.

The products of the blast furnaces were:—1. Flue dust and crude arsenic; 2. Slag; 3. Silver Bullion; and 4. Speiss.

The crude arsenic and flue dust from the blast furnaces and roasting furnaces were collected in suitable condensing chambers. The flue dust was recharged to the blast furnaces and the crude arsenic was sublimed from an arsenic refining furnace which made it ready for packing. Pure white arsenic assayed 99.98% arsenic oxide with about 0.03 ounces of silver per ton.

The slag from the blast furnaces during ore runs was rejected except when it was found to carry more than 10 ounces of silver per ton in which case it was used as revert to the blast furnaces. The slag produced while smelting speiss to remove the iron was all used as revert on ore runs because of its high silver and high cobalt content. Complete assays of the two slags were as follows:—

	Ore Slag	Speiss Slag
Silver.....	8.8 oz.	32.8 oz.
Arsenic.....	.13	.47
Cobalt.....	.44	13.97
Nickel.....	.29	1.28
Iron-oxide.....	11.63	28.54
Aluminum-oxide.....	14.15	9.75
Calcium-oxide.....	22.78	6.50
Magnesium-oxide....	8.67	4.68
Silica.....	41.13	34.03
	99.35	99.22

The silver: About 75% of the Silver in the ore charged was obtained as buttons which were easily separated from the speiss and charged into an oil-fired cupelling furnace with a capacity of 30,000 ounces. The assay of this crude silver was as follows:—

Lot	Weight oz.	Assay	Fine Silver
668	16128.80	85.88	13851.41
669	14524.67	84.91	12332.90
670	15982.97	86.71	13858.83
673	15939.22	85.99	13706.14
674	14758.00	86.11	12708.11

After about 24 hours in the cupelling furnace the silver was ladelled out and cast into bars and shipped to the Balbach Smelting and Refining Company of Newark N.J. A few lots of this silver assayed as follows:—

Lot	Weight oz.	Assay	Fine Silver
637	46320.40	99.44	46065.17
645	37893.25	99.54	37721.97
649	34339.70	99.43	34147.05
652	50230.10	99.34	49900.59
659	52646.70	99.21	51238.68

The speiss was quite brittle as a rule and easily broken with a hammer. After being run through a crusher it was ground in the ball mill to pass 30 mesh, 20% of salt being added as the speiss was charged to the mill. This speiss, known in the smelter process as high iron speiss, was roasted in 8 Edwards reverberatory furnaces fitted with mechanical rabblers and having a capacity of 2400 pounds per 24 hours. The composition of high iron speiss is shown in Table No. 3.

The product of the roasting was a chloridized speiss which was transferred from the smelter to the hypo-leaching building. Here it was treated in a large agitation cylinder, first with cold water which dissolved out the undecomposed salt and the soluble salts of cobalt, nickel and copper. This water solution was decanted onto scrap iron to precipitate the copper and was then pumped to another tank where the cobalt and nickel were precipitated as hydrates by caustic soda. This precipitate was dried, calcined to oxides, ground and barrelled for shipment. The average assay of this material was:—Silver, 15.0 oz; Arsenic 0.3%; Cobalt 40.00%; Nickel 3.00%. Nickel is lower than the usual proportion of nickel to cobalt for the reason that it is less easily converted to a soluble salt in the chloridizing roast.

After the wash with water the treatment of speiss is continued with four covers of sodium hyposulphite solution which takes all the silver chloride into solution and gives the "First Hypo Residue" which contains 20 to 30 oz. of silver. The silver was precipitated from the hypo-solution as silver sulphide which was collected in a filter-press, dried and mixed with sodium nitrate and carbonate. This mixture was roasted in an oil-fired furnace and then leached in hot water. The residue was a sponge-like mass of metallic silver which was charged to the silver refining furnace.

The "First Hypo Residue" resulting from the leaching process was returned to the smelter where it was mixed with quartz and run through the blast furnaces for the purpose of removing the iron. This was made necessary because of the contract under which the "Crude Cobalt Material" was sold, which required that the iron content be below 5%. This smelting operation resulted in a new green speiss called "Low Iron Speiss" of a composition shown in Table No. 4.

This speiss was milled with salt and roasted just the same as the "High Iron Speiss", and then washed with water and treated with hypo. The residue in this case was called "Second Hypo Residue". It was dried and

mixed with 20% sodium nitrate and 10% sodium carbonate and roasted in a reverberatory furnace. This converted the arsenic to sodium arsenic which was leached out with hot water. The dried residue was sold to refineries in Germany as "Crude Cobalt Material", the sampling and weighing being done by Ledoux and Co. of New York City.

The composition of a few lots shipped in 1912 is shown in Table No. 5.

Power for operating the smelter was supplied from the company's power plant at High Falls, Ontario, 14 miles distant from Copper Cliff. 200-300 horse power was required and 60 to 100 men were employed, working in 12 hour shifts.

A complete statement of the ore treated and the products of the cobalt plant while in operation is given in Table No. 6.

TABLE I.

Lot	Dry Weight	Co. %	Assay Ni. %	As. %	Ag. oz.	METALLIC CONTENT			
						lbs. Cobalt	lbs. Nickel	lbs. Arsenic	Ounces Silver
Buffalo Ore.									
399	48275	7.47	3.65	32.24	2135.38	3606	1762	15564	51542.73
403	45602	8.52	3.87	33.24	2169.77	3885	1765	15158	49472.93
408	45789	7.57	3.02	31.31	1823.34	3466	1383	14337	41744.46
416	44305	7.11	2.61	29.33	1680.11	3150	1156	13004	37218.64
Nipissing Ore.									
407	63795	9.22	5.49	38.02	3535.99	5882	3502	24255	112789.24
422	64652	9.01	6.40	38.72	3022.60	5825	4138	25033	97708.37
426	62304	8.03	5.18	32.90	3852.70	5003	3227	20498	120193.31
437	64703	8.85	5.49	40.82	2209.53	5726	3552	26412	71481.61
La Rose Ore.									
394	61839	8.79	7.94	37.33	1934.32	5436	4910	23084	59808.21
409	73040	9.04	6.69	39.65	1017.91	6603	4886	28960	37174.07
410	64967	9.16	8.16	40.30	1167.36	5951	5301	26182	37919.94
411	64680	9.30	6.69	39.12	1177.12	6015	4327	25303	38068.06
Kerr Lake Ore.									
400	61379	10.74	3.85	44.56	3639.12	6592	2363	27350	111682.77
406	61487	6.87	3.08	24.51	4565.81	4224	1894	15070	140368.98
420	61560	10.65	3.56	40.00	4121.77	6556	2191	24624	126868.08
427	60876	7.33	2.30	29.77	3794.77	4440	1393	18033	114935.99
Trethewey Ore.									
431	60878	10.00	1.77	48.58	1296.79	6088	1078	29575	39422.99
476	56387	10.26	2.30	41.54	3348.35	5785	1297	23423	94431.71
494	59843	9.67	2.31	49.75	1904.84	5787	1382	29772	56995.67
522	47520	9.86	1.91	46.60	1375.05	4685	908	22144	32671.19
Temiskaming Ore.									
567	59262	5.89	1.34	21.80	3659.93	3491	794	12919	108358.49
576	59030	4.41	1.07	22.30	2742.82	2603	632	13164	80954.33
595	57987	3.70	2.41	15.00	3838.55	2146	1397	8698	111293.00
608	52384	3.47	2.43	14.30	3371.76	1818	1273	7491	88313.14
Crown Reserve Ore—High Grade									
395	48624	6.42	4.04	21.16	5255.28	3122	1964	10287	127766.37
421	59776	8.40	5.45	28.73	4761.74	5021	3258	17174	142318.89
435	59666	8.75	5.61	32.42	4136.13	5221	3347	19344	123397.30
452	59047	5.84	4.86	19.29	4225.71	3448	2870	11390	124757.75
Crown Reserve Ore—Low Grade.									
396	55347	0.36	0.46	1.15	250.10	199	255	636	6921.14
401	58621	0.32	0.32	1.15	144.15	188	188	674	4225.11
405	59769	0.39	0.50	1.05	141.75	233	299	628	4236.13
415	58754	0.30	0.33	0.75	121.00	176	194	441	3554.62

TABLE 2.

Date	Mine	Lot	Milled Weight	Sample Weight	Per ct.		Total wt.gr	Sample No. 1		Total wt. gr.	Sample No. 2	
					Sam.	Water		Scales	Fines		Scales	Fines
May 2	Buffalo.....	568	59713.5	3655.5	6.12	0.22	7003	27 67	6975.33	6442	42.71	6399.29
" 9	Temiskaming.....	569	6359.7	2129.5	3.35	2.83	6969	1.50	6967.50	6713	1.45	6711.55
" 10	Temiskaming.....	570	56915.5	2446.5	4.27	2.08	7719	17.23	7701.77	7441	25.83	7415.17
" 11	Buffalo.....	571	4787.5	3379.5	6.22	0.15	8226	36.11	8189.99	7984	44.20	7940.80
" 22	Crown Reserve....	572	6426.9	3114.	4.84	0.10	7695	200.65	7494.35	9569	192.26	9376.74
" 22	Buffalo.....	573	61180.5	3827.5	6.26	0.20	7438	60.47	7357.53	7509	46.25	7462.75
" 24	Millerette.....	574	56430.5	3351.5	5.95	0.87	5004	.....	.....	5894	.....	.....
" 30	Crown Reserve....	575	63311.	3330.	5.26	0.12	8174	428.50	7745.50	8015	271.80	7733.20
			Average Sample.....5.28%.									

TABLE NO. 3
High Iron Speiss

Lot	Dry Weight	Co. %	Ni. %	Assay As. %	Ag. oz.	Fe. %	Lb. Cobalt	Lb. Nickel	Lb. Arsenic	Ounces Silver
112	56656	25.13	15.61	34.10	1181.90	14.65	14238	8844	19320	33480.86
116	40144	24.24	8.53	30.25	1617.70	23.10	9731	3424	12144	32407.47
122	70008	25.38	16.23	32.70	1299.50	14.55	17768	11362	22893	45487.70
125	34654	23.28	10.92	31.50	1888.90	19.80	8067	3784	10916	32728.97
138	62783	22.78	12.26	30.40	1703.79	21.55	14302	87697	19086	53484.52
158	31077	24.48	19.60	31.45	1650.34	15.70	6677	6091	9774	25643.81
174	42014	29.86	14.48	28.85	1557.60	12.10	12545	6084	12121	32700.50
176	84284	22.25	21.57	30.25	1280.45	13.80	18753	18180	25496	53961.36
182	68885	25.59	20.70	33.65	1290.64	11.10	17628	14259	23180	44452.87
193	58854	29.57	13.44	30.20	1357.50	15.00	17403	7910	17774	39447.15

TABLE NO. 4.
Low Iron Speiss

Lot	Dry Weight	Co. %	Ni. %	Assay As. %	Ag. oz.	Fe. %	Lb. Cobalt	Lb. Nickel	Lb. Arsenic	Ounces Silver
118	12620	28.16	25.60	31.10	1617.90	3.90	3554	3238	3925	10208.95
128	18461	28.49	28.53	30.50	1451.65	3.60	5260	3267	5631	13399.46
157	58161	24.11	29.36	31.95	1552.50	4.75	14023	17076	18582	45147.48
163	9987	25.29	34.01	29.75	1184.75	2.00	2526	3397	2971	5916.05
165	9834	33.24	22.86	29.70	1210.00	4.30	3260	2248	2921	5949.57
167	18334	32.85	26.13	26.30	979.71	5.05	6033	4791	4822	8981.00
171	19992	31.21	25.51	29.20	1420.29	2.80	6240	5100	5838	14197.12
172	86705	29.31	30.73	28.10	1268.53	2.40	25413	26644	24364	54993.95
181	21095	28.60	31.01	27.65	1111.90	2.90	6033	6542	5833	11727.77
196	17573	28.10	25.35	30.55	1720.40	3.40	4933	4455	5369	15116.26

TABLE NO. 5
Crude Cobalt Material

Lot	Dry Weight	Co. %	Ni. %	Assay As. %	Ag. oz.	Fe. %	Lb. Cobalt	Lb. Nickel	Lb. Arsenic	Ounces Silver
19B	23714	31.00	31.66	1.10	36.60	.....	7350	7508	261	433.97
20B	32783	30.92	31.63	1.10	29.70	.....	10137	10369	361	486.83
21B	43086	31.38	30.40	1.08	28.00	.....	13520	13098	465	603.20
22B	23691	31.92	28.68	1.10	25.90	.....	7562	6795	261	306.80
23B	17182	31.72	28.60	1.15	24.00	.....	5450	4914	198	206.18
24B	16759	31.47	29.18	1.10	34.80	.....	5274	4890	184	291.61
25B	26292	31.91	28.97	0.98	31.80	.....	8390	7617	258	418.04
26B	17382	28.64	25.11	1.21	48.70	.....	4978	4365	210	423.25
27B	17629	28.45	24.43	1.13	50.40	.....	5040	5015	199	444.25
28B	52363	29.84	29.10	1.30	36.40	.....	15625	15238	681	953.01

TABLE NO. 6

Statement of Ore treated and product produced during operation of Cobalt plant.

Year	Pounds of Ore Treated	Ounces of Fine Silver Produced	Pounds of Cobalt	Pounds of Nickel	Pounds of White Arsenic
1906	1767692.5	1282692.78	9021	3987	.....
1907	4560627.5	3829542.82	331151	138427	510622
1908	9857072.5	8551582.07	464171	268140	942827
1909	10651189.5	8779014.55	690737	463588	1248722
1910	9792571.0	8696624.87	346483	260756	843609
1911	6744108.0	6584102.46	238684	234323	680074
*1912	3266267.0	2798954.80	161412	169966	280486
	46642528.0	40522514.35	2241659	1539187	4500350

*9 Months

RELATION OF GOVERNMENTS TO MINING*

By Horace V. Winchell

(Continued from last issue)

Since the United States, although occupying less than six per cent. of the continental land area of the globe, and containing a little over six per cent. of its people, produces, roughly, over one-third of the world's minerals, we should expect to find among its citizens full appreciation of the importance of the mining industry, and on its statute books the best and wisest and most up-to-date provisions for the encouragement and perpetuation of this great industry.

The following statement is reproduced with slight changes from the report (No. 694) by the House Committee on Mines and Mining, Sixty-third Congress, second session, submitted May 20, 1914:

"That the mining industries of the country, and especially the metal-mining industries in our public-land States, are not keeping pace with the normal development of the country is clearly shown by the following data:

"In the population of the public-land States west of the Mississippi and Missouri Rivers there was an increase from 14,800,000 in 1900 to 19,600,000 in 1910, or 32 per cent.

"The agricultural crops of the public-land States had a valuation in 1900, of \$921,000,000, and a valuation in 1910 of \$1,950,000,000, an increase of 112 per cent.

"During similar periods the average annual valuation of all the mineral products in the public-land States increased from \$287,000,000 during the period of 1901-1905 to an average annual valuation of \$358,000,000 during the period from 1906-1910, an increase of less than 25 per cent.; whereas the production of the precious metals in the public-land States decreased from an annual average valuation of \$136,000,000 during the earlier period (1901-1905) to an average valuation of \$127,000,000 during the latter period (1906-1910), a decrease of nearly 7 per cent.

"No better illustration could be given of the contrast in the treatment of these two great national industries than the fact that in spite of this lagging behind in the mining industry during this 10 year period the National Government expended for the reclamation of agricultural lands in these public-land States not only all the money received from the sale of public lands for agricultural purposes, but also nearly \$7,000,000 received from the sale of mineral lands in these States.

"The reduction in the number of men employed in the different metal-mining industries in the public-land States tells even more clearly than do the figures of production the falling behind of the mining industry. The figures from one of these States may be taken as an example. The average number of men employed in the metal-mining and metallurgical industries in the State of Colorado for the 4-year period, 1900-1903, was 36,189; during the period from 1904-1907 the annual number of men employed was reduced to 34,364; and during the 4-year period from 1908-1911 the number of employees was further reduced to 22,560.

"Among the causes of this lagging of the mine development are the following:

"(a) The approaching exhaustion of many of the more easily discovered and richer ore deposits, and the fact that not enough other rich deposits are being discovered to supply ore to replace that now being extracted; (b) the absence of known methods of profitably working many low-grade ore deposits; (c) the wasteful methods now followed in some mining and metallurgical operations,

which, although they may bring temporary profits to mine or furnace operators, are reducing the national wealth in a manner that can be remedied only by the discovery and use of more efficient methods.

"Of a number of our important mineral resources, we have for both the present and future needs of the Nation only an adequate supply. The utilization of certain of these resources, such as coal, oil, and natural gas, destroys them. Common prudence demands, therefore, that through the necessary researches the Nation should learn how to use this one supply of its mineral resources more wisely and more efficiently.

"The loss of life in the different branches of mining industry is a discredit to the Nation. It calls for more extended inquiries and researches on the part of the Federal Government, and a proper dissemination of the results obtained; it calls for more stringent police supervision or inspection by the State, and for more determined cooperative effort on the part of both the miners and the mine owners in the way of mining and enforcing safety regulations.

"The National Government should do its full duty in this matter without further delay. It should lead in a great movement for the practical conservation of life and resources.

"Congress is now appropriating as an aid to agricultural advancement about \$28,000,000 per annum. These funds are being expended and the work authorized is being carried forward through a well-organized department with a Cabinet head and with nearly 14,000 employees.

"That these large expenditures have resulted in still larger benefits to the country there can be no doubt, and one of the evidences of the benefits is to be seen in the large increases in the aggregate value of the farm products of the country, which had an estimated value of less than \$5,000,000,000 in 1898 and nearly \$9,000,000,000 in 1912.

"The conditions underlying agricultural progress differ as to many details from those associated with mining, but the broad general principles of progress are the same, and the favorable response to the national aid for agriculture is itself an evidence of the favorable result that can be depended upon if similar aid is extended to mining. Furthermore, the less extended actual experience growing out of the more limited expenditures through the United States Geological Survey and the Bureau of Mines on behalf of the mining industry furnishes specific evidence of the larger benefits that may be expected to result from larger expenditures for mining investigations. Thus, under the Bureau of Mines, through a small expenditure, the saving in national wealth through stopping the waste of natural gas in one and one-half years has aggregated more than \$15,000,000, which is several times the total cost of the maintenance of the Bureau of Mines from its beginning.

"The benefits that may be expected from more liberal aid to the mining industry will come (1) through a better safeguard of the health and lives of those engaged in mining and metallurgical operations; (2) through the lessening of the unnecessary waste in the mining and treatment of the various mineral products; (3) through increased efficiency in mining operations by the improvement of health and safety conditions; (4) through the development of more efficient and cheaper methods in the treatment of low-grade ore deposits, which are either not now worked at all or worked only in their richer parts or pockets.

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.

These benefits may come either through the discovery of new methods in connection with the researches of the Bureau itself or through its activity in stimulating researches by private parties.

"A brief statement of facts will indicate in a general way what the National Government is doing to aid the development of each of its two great basic industries and what in turn these two industries are contributing yearly to our national wealth and progress. Although the figures are not fully comparable in all respects, they will be found to be essentially correct.

"What these two basic industries do for the Nation:

Item.	Agriculture including forestry.	Mining and mineral industries.
Number of employees	13,000,000	2,300,000
Yearly value of products	\$10,500,000,000	\$4,600,000,000
What each worker in these industries contributes to the national wealth yearly	\$800	\$1,800
What each industry contributes to the freight tonnage of the country yearly, per cent.	22	60

"What the National Government is doing for each of these industries:

Yearly Appropriation.	Agriculture.	Mining.
For education—		
From direct appropriation	\$2,500,000	.....
From land grants	1,030,000	.....
From Smith-Lever Act for demonstration educational work	480,000	.....
For 52 experimental stations, one in each State and Territory	2,550,000	.....
For general researches and other work to aid agriculture and mining	22,410,000	\$1,967,000
Total	\$27,970,000	\$1,967,000
Per capita contribution from the people of the U. S. for advancement of these industries	\$0.28	\$0.02
Of this contribution the per capita expenditure for safeguarding the lives of 2,300,000 employees in the mining industry is about one-half of 1 per cent. per annum		.005

"Nothing can show the relative national neglect of the mining industry more clearly than does the above tabular statement; and this neglect is all the more difficult to understand in view of the hazards of that industry and the other conditions that should appeal to the humanitarian as well as to the commercial instincts of the American people. But another fact that tells the story with equal emphasis is that during the past 10 years, in addition to the large sums paid out of the National Treasury for the benefit of agriculture, as indicated above, and the payment towards the reclamation of agricultural lands in the Western States of all funds arising from the sale of public lands in those States, even the proceeds of the sale of the Nation's mineral resources in like manner have gone not to aid mining but to the reclamation of additional agricultural lands.

"Agriculture is much the larger of the two industries; it embraces a large number of persons, more widely distributed, and each acting as an independent agent. Its products, supplying the country with food, and clothing, bring this industry even closer to the lives of the people than does the mining industry, though the latter supplies them with the fuel that cooks their food, heats and lights their houses (which are built largely of mineral products), operates and supplies a large share of the materials and all the machinery of their factories, conducts and operates largely their facilities for transportation and communication, and supplies more than 60 per cent. of the total freight tonnage of the country. Indeed, the mining industry is in large measure the real basis of our modern civilization and national life.

"But, more than the above, there must be some special reasons why the mining industry has received relatively so little aid from the National Government, and these are to be found, no doubt, in certain misapprehensions concerning the industry. Mining is usually regarded as an industry

comprising the operation of a few large, highly profitable properties, such as the old Comstock mines in Nevada, the Treadwell mine in Alaska, or the Homestake mine in South Dakota. It is usually considered to be an industry controlled by a few parties, the owners of the large properties mentioned, who would gladly avail themselves of an opportunity to unload on the National Government the cost of conducting those researches in which they are particularly interested. Therefore, it is usually considered as an industry that should be allowed, and even required, to take care of itself. These assumptions are far from correct.

"The facts of the situation are:

"(1) These large, highly profitable properties are few in number, and, so far as known, their owners have never joined in a request for Government appropriation to aid in the mining industry, nor have they been given any special consideration either in the establishment or in the plans of the U. S. Bureau of Mines. These mine owners have neither asked for assistance nor have they endeavored to unload upon the Government any investigations of their own. On the contrary, at the request of the Bureau of Mines, a number of them have expended considerable sums from their own funds for investigations that promise to be useful not only to them, but to other less important mining developments in which they are, and were in no way interested.

"(2) Although the number of large mines is small, there is a large number of small mines. The records show that in the country as a whole there are about 40,000 coal mines, metal mines, and quarries and about 170,000 oil wells that are operating on a smaller or larger scale. In addition there are many plants for treating ore by mechanical concentration, smelting, or other processes and various mineral-industry plants in different parts of the country. Few seem to appreciate the importance of helping those who hold these small properties to find methods of operation by which the properties can be worked at a profit instead of being helplessly transferred to a few large corporations which alone may have the funds for developing the processes that will make profitable operation possible.

"(3) The most urgent appeal for larger national aid to the mining industry comes from and on behalf of the 2,300,000 employees of the different branches of the industry, who are asking the aid of the Government in the development of safer and more healthful working conditions. The humanitarian appeal should be given precedence over calls for appropriations to advance commercial gains. It comes from employees working under hazardous conditions, a majority of whom are unfamiliar with our language, our laws, or our institutions. These men have been led to believe that the Government of the United States is interested in their welfare and has been planning to aid in bringing about safer and healthier conditions for them; but owing to long delays and slow progress in the Government's work, they are now becoming discouraged in their belief that such plans would be realized.

"(4) Another important end to be sought through these larger contributions to the aid of the mining industry is helping the consumers or users of mineral products, who are distributed throughout every part of the country. Mineral products are becoming more and more indispensable to the domestic life of the people and to our manufacturers, as well as being the basis of transportation facilities and of the products to be transferred. Under normal conditions, as our mines become deeper and our mineral resources are depleted, not only the hazards of production but also the per capita cost of mineral products is increasing and one important purpose of the larger investigations proposed in behalf of the mining industry is to find how the cost to each consumer may be kept down to a minimum.

"Some special reasons why mining should receive larger national aid are enumerated below:

"(1) Agricultural products, if ordinary care is given to our soils, will be supplied continuously by annual crops. But as regards mineral resources the case is different. Our mines can produce only the one available supply; this one supply must meet the future as well as the present needs of the Nation; and a century's experience has clearly shown that our use of the more important of these resources, such as mineral fuels, precious and other metals, and potash and phosphate deposits, will increase much more rapidly than will our population.

"(2) Although certain of our mineral resources, such as the metals, are destroyed rather slowly in use, other essential resources, such as coal, oil, and natural gas, are consumed or destroyed beyond recovery.

"(3) In the utilization of certain of our mineral resources such as natural gas, petroleum, coal, zinc, and some of our other metals, there are large losses or wastes that are believed to be unnecessary, and it is a wise duty of the National Government to aid in the prevention of such wastes. These wastes now exceed \$1,000,000 per day.

"(4) And more important than all the above in their appeals for the larger aid of the Federal Government are the hazards of the mining industry—the accidents that yearly result in such large losses of life and the unfavorable health conditions in many mines and metallurgical plants which affect adversely the vitality of employees. None of these conditions is encountered in agriculture, but they are in a peculiar way characteristic of the mining industry; and these conditions alone more than justify additional expenditures from the Federal Treasury."

Still another reason why federal aid should be extended to the mining industry is found in the fact that few countries are independent and self-sufficing in their production of minerals and ores. This fact is brought prominently to the front at the present time, by the interruption to the world's commerce occasioned by war. In speaking of this situation, the Director of the United States Geological Survey uses the following language:

"I believe the mineral wealth of the United States is in largest measure the foundation of the marvelous growth of the last few decades. Industrial America! Think to what a degree the industries of America are based upon our ores and mineral fuels, or figure if you will the percentage of railroad tonnage that originates at the mine.

"Not only is our country a world-leader in the output of such essential minerals as coal, petroleum, copper, zinc, iron, lead, phosphate—and in three of these it exceeds all other countries put together—but as far as such things can be measured or estimated we are blest in the possession of the largest reserves of many of the more important of these minerals. No other country can in any sense compare with the United States in the degree of industrial independence afforded by the possession of these mineral resources. The raw material is at hand to enable us to win and maintain supremacy as a manufacturing nation.

"Yet, under this most-favored nation clause, the catalogue of our mineral resources is not the complete list of minerals essential to modern civilization; a few items are missing, others are present apparently only in insufficient quantities, and the quality or locality of the deposits of still other minerals may be unfavorable to present day utilization. Thus it happens that the nation is not wholly independent in its mineral industry. The list of what we lack is short. We are wholly dependent on other countries for only four principal items—tin and nickel, potash and nitrate. Among the minerals of which the United States has a deficient supply are manganese, platinum, gems and asbestos. Still other minerals it has been more profitable to buy abroad than at home, such as chrome ore, barytes, flint pebbles, magnesite, mica and graphite. * * *

If it is then important for the people and government of the United States to aid and encourage the development of its own mineral resources, how much more important should such efforts be for those nations which have not the generous provisions of nature in the shape of easily won mineral deposits. Nor is it alone the federal government which should evince an interest in the working of mines. Every state and province should do its share, and instead of looking upon mines as something to be taxed to the very limit or beyond, should feel that **it is of intimate and vital importance to every citizen of the state or province that its mines and quarries be worked to the highest stage of productivity of which they are capable.** Far greater than the value of the taxes paid into the state treasury is the benefit derived indirectly from great institutions for the production and working of minerals; and the operation of steady mines and metallurgical plants in a community is of incalculably greater importance than the derivation of direct revenues to enrich and often debauch the public treasury. For concrete examples of the truth of this statement look at Chile with its nitrate deposits paying millions yearly to the government and then turn to Sweden and observe its wise policy of encouragement of the development of its iron mines. The former country has not only not aided in the nitrate industry, but has done its best to turn it into cash for the government treasury, much to the disadvantage of public morals; the latter country has given its lands freely, has appropriated large sums for railroads and for other necessities to those who would develop an industry which would afford permanent employment to large numbers of laborers.

Full discussion of this subject would involve consideration of the bearing of mineral production on all lines of industry; it would necessitate a study of modern civilization and industrial development in all lands. For those who are already students of the subject, such elaboration is superfluous; to those who are not, it would be tiresome and unread. Enough has been said to indicate its importance. In conclusion, the following propositions may be taken as established beyond question:

1. **From the dawn of civilization to the present time national standing has been dependent on and conditioned by mineral wealth and consumption.**

2. **Next to agriculture no industry so deserves the sympathy and aid of governments.**

3. The attention of legislators, should not only be invited but compelled to the necessity for wise and sympathetic legislation in connection with the mining industry.

4. It is incumbent on every engineer and mining man, and indeed upon every citizen to insist that our mining laws shall be most carefully framed so as best to promote the interests of the mining industry, and hence of every industry throughout the entire length and breadth of the land.

According to General Manager James MacNaughton of the Calumet and Hecla Mining Co., the use of the Carr bit has resulted in an increased output per miner equivalent to his total output of a few years ago, thus not only decreasing costs but making available tremendous tonnages of low-grade ore that would not otherwise be commercial.

The decision of the British Admiralty to give Nova Scotia coal a thorough test will probably result in the removal of the prejudice in favor of Welsh coal and give a new outlet for the coal of Cape Breton.

CANADIAN SUPPLIES OF IRON AND STEEL IN RELATION TO MUNITIONS OF WAR*

By Thos. Cantley

The steel industry in Canada is represented by plants in three of the Eastern Provinces—Nova Scotia, Quebec and Ontario. Those of the first and last mentioned Provinces are the most important, supplying over 99% of the total production.

Probably the first effort in iron smelting in Canada was made in the Province of Quebec. During the early decades of the last century we find that various small enterprises were started in all three Provinces, charcoal being used as fuel and local ores smelted. The amount of metal produced, however, was very small.

The Londonderry district in Nova Scotia was the first to assume commercial importance, and quite modern furnaces and plant were laid down about the middle of the last century. Iron was made here about the same date and a rolling mill was installed in 1860. It is of interest to note that the pig iron made at Londonderry had quite a good reputation, and was in demand. It is said that owing to its superior quality, the British War Office, upon the recommendation of Sir William Fairbairn and others, used it for the manufacture of ordnance in these days, and imported it into England for the purpose. About 1875, there was further development in this district with important additions to plant; coke pig iron being then made for the first time in Canada in a commercial way. In a paper written on the iron and steel industry in 1885, Londonderry is referred to as the "site of the most important Iron Works in the Dominion." Up to 1887 it had produced over 200,000 tons of pig iron smelted from local ore; 42,000 tons of bar iron and forgings, and 40,000 tons of nail plate, wheels and castings. Operations at Londonderry have since been carried on intermittently, pig iron having last been made in 1908, and steel in 1912. Farther east at New Glasgow, the first steel was made on a commercial basis in 1883, when two 20-ton acid lined open hearth furnaces were put in operation. Imported pig was used. Four years later the basic open hearth process was adopted, thus making it possible to use local pig iron. Since this date all steel made in Nova Scotia has been exclusively basic open hearth. In the Pictou district the first iron was made in 1826, by the General Mining Association, then operating collieries at Albion Mines, when they smelted local ores using native flux with beehive coke made from Pictou coal. Owing to the refractory nature of the ore, the venture was not a success and operations were discontinued. In Cape Breton the first pig iron and steel was made in 1899, and from this date Cape Breton has been the most important steel district in the Province.

In 1737 the right of mining and smelting iron ore in the District of St. Maurice, near Three Rivers, was granted to a company by Louis XIV. From that date until a year or so ago mining, dredging, and smelting of bog ore has been carried on almost continuously in the district, on a small scale. Attempts to smelt iron on a commercial scale were made at Moise in 1867; at St. Urban in 1873, and at Hull in 1872 and 1887; but without commercial success. At Radnor and Drummondville, furnaces have been operated continuously from 1887 to 1912, using local ore, with locally made charcoal as fuel; producing on an average about 8000 tons per annum. At present there are no blast furnaces in operation and steel is only produced in small open hearth and electric furnaces, for making castings, or by the crucible method for special qualities; the tonnage involved being small.

One iron furnace was erected in Leeds County about 1800 and another at Normandale a few years later. These initial efforts proved failures, but in 1832 operations were resumed and continued until 1847. The Marmora furnace established in 1810 was operated unprofitably at intervals until 1875. A furnace was erected at Madoc, and operated for eight or nine years. Furnaces were also built at Houghton, in 1854, and at Burnt River, in Haliburton County. All these enterprises proved to be commercial failures, and in 1892 the Province of Ontario had not a single furnace in blast. Two years later in 1894, furnaces were put in operation at Hamilton by a company which is now incorporated with the Steel Company of Canada. These furnaces have been operated continuously since that time and the growth of the industry during the following decade was rapid.

Present Conditions

The industry as it exists to-day may be conveniently divided into two groups, the one in Nova Scotia, and the other in Ontario.

Nova Scotia.—In the province, the Nova Scotia Steel and Coal Company and the Dominion Steel Corporation operate under almost identical conditions. They use ore and coal from the same beds and generally are confronted with the same metallurgical problems. All the steel is made from Wabana (Newfoundland) ore, smelted with retort oven coke made locally from Cape Breton coal, while local flux is used. The blast furnaces are seven in number having a daily capacity of 1930 tons. There are eighteen open hearth furnaces including mixers, and two 15 ton Bessemer Converters.

Ontario. The industry here may be sub-divided into the Niagara Peninsula and the Lake Superior groups. All the important companies operate, however, under very similar metallurgical conditions.

In the Niagara peninsula, the following important companies are operating:

The Steel Company of Canada, with furnaces at Hamilton.

The Canada Iron Corporation, with furnaces at Midland.

The Canada Furnace Company, with furnaces at Port Colborne.

The Standard Iron Company, with furnaces at Deseronto.

In the district there are seven blast furnaces with daily capacity of 900 tons. The greater part of the ore and all of the fuel for these furnaces, is imported, although a couple of the smaller companies use a certain tonnage of local ores. Seven open hearth furnaces provide a steel making capacity of about 350,000 tons per year.

In the Lake Superior district, the following companies are located:—

The Algoma Steel Corporation, with furnaces at Sault Ste. Marie.

The Atikokan Iron Co., with furnaces at Port Arthur.

In this district there are four blast furnaces with a capacity of 1,050 tons per day, 5 steel furnaces and 2 Bessemer converters.

The Atikokan Iron Company has a furnace in the district with a capacity of 100 tons per day, which has been idle since 1911.

The ores smelted are partly native, from the Helen field and Magpie mines, but the greater part is imported from

*Read at a meeting held on November 10th, 1915, of the Montreal Metallurgical Association. This paper will also be presented and discussed at the Annual Meeting of the Canadian Mining Institute, March 1st, 1916.

the American Lake Superior ore field. The fuel used is, in part, locally made charcoals, but the greater part is coke, imported from Illinois or Pennsylvania. In 1910 a battery of 110 Koppers coke ovens was built at the Sault for the purpose of coking imported coal at the furnace, thus saving the breakage inevitably produced in the transportation of coke. In 1913 some 600,000 tons of coal was imported for this purpose and 419,000 tons of coke was made.

The consumption of materials used in smelting iron ores in Canada in 1914 was: ore etc, 1,358,184 tons, limestone 419,864 tons, coke 910,887 tons, charcoal 883,625 bushels.

The Nova Scotia industry is in the centre of Cape Breton coalfield. It supplies itself with coke and is thus self-supporting. The Ontario industry obtains all its fuel supply from the United States, either in the form of coal or coke.

The following is a list of manufacturers of oven coke in Canada:

Company	No. and Type of Ovens	Location of Ovens
Intercol. Coal Mfg. Co., Montreal	36 Bee Hive.	Westville, N.S.
Londonderry I. and Mg. Co., Limited, Montreal	97 Bee Hive.	Londonderry, N.S.
Nova Scotia S. & C. Co., New Glasgow, N.S.	120 Bernard.	Sydney Mines, N.S.
	30 Bauer.	
Dominion I & St Co., Sydney, N.S.	620 Otto Hoffman.	Sydney, N.S.
Atikokan Iron Co Limited, Port Arthur, Ont.	100 Bee Hive	Port Arthur, Ont.
The Algoma Steel Corp., Sault Ste Marie, Ont.	110 Koppers.	Sault Ste Marie

There are in Canada, twenty-two blast furnaces, having a total theoretical capacity of 1,500,000 tons per year. These are in twelve separate plants and are owned by nine companies.

It is improbable that a greater tonnage than 1,350,000 can be obtained in 1915.

There are four steel plants in Canada containing thirty open-hearth furnaces and four Bessemer converters, and having a total capacity of 1,250,000 tons of steel a year. It is improbable that this amount can be exceeded during the coming year by more than 100,000 tons, and it should be borne in mind that 300,000 tons of this capacity is Bessemer steel which is not accepted in the manufacture of munitions. In addition there are eight or nine steel-casting plants, operating either small open-hearth furnaces or converters.

The production of steel ingots and castings in 1914 was: open hearth 549,716 tons, Bessemer 144,447 tons, other kinds 284 tons.

Electric Smelting.—In the above estimates we have not made any allowance for such additional tonnage as might be obtained by electric smelting. The tonnage of steel derived from this source in 1913 was under 5000 tons, not including the tonnage of ferro-alloys, which amounted to 8000 tons. The problem of electrically made steel is a large one. Melting scrap in a relatively inexpensive steel-furnace, where electric power is cheap, is very attractive. This no one doubts. The difficulties that may be encountered in securing any great tonnage in this way, while problematical, are bound to be enormous, and it is unlikely that our figures will have to be changed materially because of the tonnage derived in this way.

The following is a list of the companies making ferro-products or steel in the electric furnaces.

Name of company, address, location of plant, and products:—

The Electric Reduction Co., Buckingham, P.Q., Buckingham, ferro-phosphorous.

Electro Metals, Limited, Welland, Ont., Welland, Ont., ferro-silicon.

Electric Steel & Metals Co., Welland, Ont., Welland, Ont., steel castings.

Algoma Steel Corporation, Sault Ste. Marie, Sault Ste. Marie, ferro-silicon.

The Moffat Irving Steel Works, Limited, Toronto, Toronto, steel castings.

Tivani Electric Steel Co., Belleville, Ont., Belleville, steel castings.

Development of the Industry

The production of war munitions will doubtless be limited as much by the capacity of the blowing mills in this country as by the capacity for producing steel ingots.

In reviewing the statistics of the industry in reference to the present crisis it will be observed that its development has been slow. The first great impetus was given by the Iron and Steel Tariff of 1887 introduced by Sir Charles Tupper. It is due to his statesmanship that the conditions were established on which our present achievements rest. With the subsequent changes in import duties there was little advance in the industry until the second stage of development commenced at the close of the last century. This was brought about by the action of the Government in introducing a graduated system of bounties. This system resulted in large iron and steel enterprises in Nova Scotia and Ontario, culminating in 1913 in the production of 1,128,967 tons of pig iron and 1,168,993 tons of steel. It is a melancholy reflection that even in such a "banner" year, the iron and steel production of Canada was less than half our total requirements. During 1914 owing to the World-wide depression, the output declined considerably.

After the outbreak of hostilities the British War Office first looked to the United States for supplies of heavy ammunition. Thanks however to the initiative and energy displayed by the Canadian Minister of Militia, General Sir Sam Hughes, an invitation was shortly thereafter extended to Canada to help meet the requirements of the army in this respect. That it was possible to accept this invitation may be ascribed to the satisfactory condition of the iron and steel industries in Nova Scotia. Steel makers in that province were thus in a position to supply the steel and to make the forgings for shells. The Shell Committee co-ordinated this work and that of other manufacturers to produce the finished ammunition and in this way completed the first order for 200,000 shrapnel shells.

Between October, 1914 and June 10th, 1915, munition orders alone to the amount of over \$160,000,000 were placed in Canada providing employment for thousands of workmen engaged not only in the iron and steel and allied industries but in other trades as well as to a large army of mechanics who would otherwise presumably have been without employment. As an example of the effect of the munition business in stimulating other than the metal industries it may be cited that over a million ammunition boxes for the making of which over ten million feet of lumber was used were supplied while a further twenty-five million feet of lumber has been made into cases to hold other munition exports.

During the first nine months of 1915 there was shipped to Great Britain from Canadian ports more than 4,229,000 shells about twenty-five per cent of which was fixed ammunition. Incidentally it may be of interest to mention that Nova Scotia Steel Co., the first of the Canadian steel companies undertaking to supply shell steel and shrapnel forgings, made at the company's New Glasgow plant during the twelve months ended October 31st last, a total

of 2,145,525 shell forgings, over twenty per cent of which were of the largest size for high explosive shells yet produced in Canada.

During the past spring and summer Canadian exports increased in volume at a rate never before experienced in the history of the country. This condition of affairs is largely attributable to the establishment of the business in munitions. Canada had built up a steel industry. In addition to what has been already accomplished the Dominion will probably during the next fifteen months, export to Great Britain munitions aggregating in value not less than two hundred millions of dollars—possibly three hundred millions of dollars—fully eighty per cent of which will be wholly the product of Canadian labor.

Whether the value of these exports will reach the higher figure mentioned depends merely on whether a sufficient supply of steel either from Canadian furnaces or elsewhere is obtainable. If the steel can be secured the engineering shops of the country can without doubt undertake the assembling and finishing of shells to the value of more than \$300,000,000.

The largest production of steel ingots in Canada in any year was in 1913, when a total output of 1,048,538 tons was recorded. In 1914 this declined to 775,000 tons. Since the close of 1913, the steel producing capacity of the Canadian plants has been only slightly increased, and consequently, it is doubtful if the production this year will exceed at the utmost 1,250,000 tons.

Meanwhile in the United States, an extraordinary situation at present obtains. Never in the history of the steel industry of that country has the demand for steel been so great; and buyers for steel of every description are experiencing increasing difficulty in securing supplies. During the month of October last, the United States production of pig iron exceeded 3,000,000 tons, a monthly output never previously attained. It was greater in fact than the September record by over 95,000 tons, and was almost double the production made during October, 1914. The amazing consideration is that while the United States to-day is producing pig iron at the unprecedented rate of 37,500,000 tons a year, prices are advancing daily. The advance in price during the first week in November was 50 cents a ton on coke iron and \$1.00 a ton on charcoal iron; while during the year basic iron has advanced from \$12.50 to \$15.80 a ton. The demand for and the increase in price of steel is even greater than in the case of pig iron. Indeed the situation is unique as regards the price of finished steel, and at present it is difficult to find a seller who can make deliveries. Eastern and Western mills are alike congested with business, and very few indeed have any open capacity.

Plate mills are fully occupied with car, locomotive and ship-building work. The railways, which were almost entirely absent from the market for many months past, have recently given orders for large quantities of rails; while about 300,000 tons it is understood, have been booked for export within the coming two months to Russia. During October, the American railways bought more than 27,000 cars, and probably more than 10,000 have been booked for export to the Russian Government. As regards steel plates, the increase in price is even greater, while it has failed to discourage demand in the least; in fact in many cases, price is no longer a consideration, but rather to find a mill that will guarantee deliveries. While the situation as regards structural steel is grave, it is in forging billets that the situation is most acute. Steel bars in November 1914 sold at Pittsburgh at \$1.10. In November 1915, the price was \$1.50 or a 36 per cent advance. In forging billets the difference was much greater, the figures being \$25 and \$42 respectively; or an advance of sixty-eight per cent. Indeed high carbon steel sold in large quantities at previously unheard of prices. Even

during the closing days of October orders aggregating more than 60,000 tons of high carbon forgings billets were reported as having sold as high as \$56.00 per ton, Pittsburgh. Further it is stated that the Entente requirements, now becoming insistent for high carbon shell steel, alone represent the enormous aggregate of 20,000,000 tons.

It is therefore clearly evident that Canada and the United States will, during the coming year, face a steel famine unprecedented in the history of this continent. The outcome will be as interesting as it will be far-reaching. It will probably reduce very largely some of the profits so easily shown on paper as capable of being earned by munition plants yet unbuilt, and which must necessarily be dependent for a supply of raw material on producers of iron and steel.

It will be seen from the above statements that a strong and evenly balanced iron and steel industry constitutes an important national asset.

COBALT SHIPMENTS.

Cobalt, Jan. 8.—Ore shipments for the week were considerably over double that of the preceding week. Ten shippers sent out fourteen cars, five of which went to American smelters. Included in the list was a copper shipment sent out by the Rand Syndicate to Chrome, New Jersey. Temiskaming had two cars and was second on the list, Nipissing taking the lead. There were no bullion shipments for the week ending last night.

Silver ore shipments for the week ending yesterday were as follows:

Mine.	Pounds.
Coniagas.	121,525
Penn. Canadian	100,089
Buffalo.	62,255
Nipissing.	131,168
Peterson Lake	66,000
Dominion Reduction	88,000
Mining Corporation—	
Townsite City	71,234
Cobalt Lake	65,713
Beaver Mine	64,763
Temiskaming.	127,212
Total Silver	897,959
Copper—	
Rand Syndicate	49,912

A press despatch from Seward, Alaska, gave the information that on December 29th the steamer North-western sailed from that port for Seattle, Washington, having on board \$550,000 worth of gold bullion brought to Seward by dog-teams from Iditarod, and \$50,000 worth of copper ore. It was stated, further, that the Northwestern was to take from places on Prince William sound about \$100,000 worth of copper ore, also for Puget sound, where it would most likely be smelted at the Tacoma smelter.

At Vancouver, B.C., on December 28th two writs were issued at the instance of Zera Strong against A. N. C. Treadgold, of London, in connection with the sale and purchase of placer gold claims in Yukon Territory. One of the writs is for a balance of \$21,300, balance of principal and interest alleged to be due the plaintiff on purchase price of his claims, and the other is for 10,000 shares in the Granville Mining Co., stated to have been given to the defendant for sale on plaintiff's account.

THE MARKET FOR MOLYBDENITE

The Director of the Imperial Institute of the United Kingdom, the Colonies and India, South Kensington, London, S.W., under date of 17th December, 1915, says in a letter to Mr. T. W. Gibson, Deputy Minister of Mines, of Ontario:

With reference to the disposal of the molybdenite which is becoming available in Canada, I may say that the British Government has recently taken action with a view to securing supplies of molybdenum ores for munition purposes, and the market for the ores in this country is now under Government control. An official arrangement has been made with regard to Australian supplies and I therefore consulted the Ministry of Munitions as to the procedure which should be adopted with regard to Canada.

I am informed by the Ministry that it has been decided to leave the question of Canadian supplies of molybdenite in the hands of the Dominion Shell Committee at Ottawa (now I believe merged in the new Imperial Munitions Board), who have been notified that the British Government will purchase up to 50 tons of molybdenite ore. The arrangements have been left entirely in the hands of this committee and it is therefore desired that all communications on the subject of Canadian supplies should be addressed to the committee or to the new Munitions Board.

I suggest that this information should be made public in Canada, if this has not been done already, as the Imperial Institute is receiving a considerable number of enquiries from that country with reference to the disposal of molybdenite ores or properties, and is of course still ready to be of any service on this side that may be required.

With reference to the disposal of molybdenite properties, the following persons and firms have applied to the Imperial Institute for information regarding such properties with a view to purchase: Mr. R. Woodburn Kirby, 26 College Street, London, E.C.; The Osram Lamp Works, Ltd., Brook Green, Hammersmith, London, W.; L. LePersonne and Co. (Metal Department), 99 Cannon Street, London, E.C.; Mr. J. C. Stead, 57 Chancery Lane, London, W.C.

Enquirers in Canada might be given these names, but it must be understood that the Imperial Institute cannot assume any responsibility regarding firms and persons mentioned.

The samples of molybdenite concentrates prepared at Orillia by the Orillia Molybdenum Co., which you forwarded, are too small for complete investigation, but the following results of their mineralogical examination may be given. No. 1 consists of coarse flakes and is apparently clean molybdenite. Nos. 2 and 3 consist of smaller flakes (No. 3 being the finest) and contain mica, but the molybdenite largely preponderates in both samples. No. 2 was found to contain about 6½ per cent. of biotite mica (including a little quartz) and a little pyrite. No. 3 contains about 12½ per cent. biotite mica (including a little quartz) and, like No. 2, also included a little pyrite. It would therefore appear that the percentages of molybdenite present in these concentrates are not below the figures which you quoted.

The Ministry of Munitions has asked for information as to the quality of the samples and I am accordingly transmitting these particulars to them.

PERSONAL AND GENERAL

Mr. Wm. Alderson, superintendent of the Hollinger gold mine, has resigned.

Mr. Chas. Fergie, of Montreal, has been nominated as vice-president of the Canadian Mining Institute.

Mr. J. A. Dresser, of Montreal, has been nominated as a councillor of the Canadian Mining Institute.

Mr. Duncan Chisholm, of Toronto, has taken an option on the Jamieson claims in Rodd township.

Mr. M. W. Summerhayes has been nominated as a councillor for the Canadian Mining Institute.

Mr. O. E. Le Roy, chief geologist of the Canadian Geological Survey, has obtained a commission in the Seaforth Highlanders.

Mr. E. F. Cartwright, of Alden, N.Y., and Mr. R. W. Cartwright, of Ridgeway, Pa., are at Porecupine.

Mr. H. C. Anchor is in charge of the Dome Extension property at Porecupine, where exploration has been resumed.

Dr. W. G. Miller and Mr. Cyril W. Knight, of Toronto, attended the meeting of the Geological Society of America at Washington, D.C.

Dr. W. G. Miller and Mr. T. W. Gibson, of the Ontario Nickel Commission, are en route to Cuba.

Mr. Geo. T. Holloway, chairman of the Ontario Nickel Commission, is in England.

Mr. J. B. Tyrrell expects to leave shortly for England.

Mr. Geo. B. Church has returned to New York from Juneau, Alaska.

Mr. G. G. S. Lindsey expects to return to Canada in February.

Drs. McCracken, of Worthington, Coutts, of Garson Mine, and Freeman, of Leveck, of the Mond Nickel Co.'s medical staff, have enlisted for service overseas in the Army Medical Corps.

Brigadier-General John Carson, honored by his King in being created a Civil Commander of the Bath, is a striking example of the "self-made" man. It is only a few years ago that he was an insurance agent—but a thoroughly aggressive one. His energy and capabilities have placed him where he is to-day. The Brigadier-General is best known as the president of Crown Reserve Mining Co. It was Crown Reserve that gave him his present wealth.

M. Beatty & Sons, Ltd., Welland, have received an order from the Confederation Construction Co., contractors on section 3, Welland Ship Canal, for six electric hoists—for a concrete handling plant.

According to our Newfoundland correspondent this winter promises to be the best mining season that Newfoundland has ever enjoyed. The great iron deposits are to be worked all through the winter on an unprecedented scale. For the first time the five iron mines of the Dominion Iron and Steel Company are all being worked.

In its excellent annual review number issued on January 8, our esteemed contemporary, the Engineering and Mining Journal, of New York, estimates Canada's gold production in 1915 at \$15,875,000 as compared with \$15,925,044 in 1914. As a matter of fact Canada's gold production in 1915, instead of being smaller than in 1914 was nearly \$3,000,000 greater.

SPECIAL CORRESPONDENCE

PORCUPINE AND KIRKLAND LAKE

Dome.—The December returns for the Dome Mining Company, now officially made, complete the record for the year. The total for the twelve months of 1915 show that the Dome produced \$1,468,272. The average grade for the year was \$4.56 per ton. The recent grade during the last six months has considerably exceeded this, since ore has been mined from the new and higher grade orebody. It is a fact, however, of importance, that 70 to 71 per cent. of the total ore is still coming from the original Dome or Glory Hole. The mill and mine will not be in good shape to handle this new ore for a month or six weeks yet. After that it is probable that the grade will be slightly increased, though there is not any intention to use the higher grade of the ore to force production. Tonnage treated during the year was 317,873. The last month's crushing of 30,120 tons was considerably more than 21,000 tons higher than of any previous monthly period. Bullion produced had not a corresponding increase, it being less than \$1,000 higher than in November. The production for the month of December was 30,120 tons milled, value \$160,950.70, with an average per ton of \$5.34.

The production this month will show a considerable increase as the new Hardinge mill has been installed. The manufacturers fully expect that the ball mill will treat over 300 tons a day, but it is not to be anticipated that it will reach this maximum until some months of trial. The ball mill is of the eight foot, thirty-inch type and has been installed alongside the stamps and will do almost the same work. Two more pachuca tanks have also been installed. These are nine feet in diameter instead of eight feet. The two extra sand tanks and Dorr Thickeners will be of the same size. It is the intention of the management to install more ball mills as the opportunity occurs and it is desired to still further raise tonnage. At the Dome and in the Porcupine Camp generally it is believed that the ball mills will handle Porcupine ore under certain conditions better than the stamps, therefore, not only will ball mills be introduced to take care of further tonnage, but as stamps are worn out they will be replaced by ball mills.

Excellent progress is being made with the new central shaft at the Dome. Raises have now been holed through from the 600 foot to the surface and it is confidently expected that the new shaft will be completed and ready for use before the date it was determined, namely, the first of March. Cross cuts from the present working shaft to the new central shaft have been opened up and a considerable body of ore indicated by diamond drilling, but not before actually put in sight. This orebody is 40 feet wide and 200 feet long as at present determined.

Hollinger.—The Hollinger production for the 12th period of the big mine in 1915 easily broke all records. The production of \$210,558 gross profits was not less than \$25,790 more than at any previous period of the Hollinger history. This very considerable increase was due to the fact that over 1,000 tons more ore was crushed and also that the grade was better by 65 cents a ton. Both mining and milling costs were higher, but general costs were lower, so that the total costs for the period ending December 2nd were \$3,522, in which we include 0.882 milling costs per ton and 1.982 mining costs per ton. It is to be remarked that the total costs

for the past seven periods average \$3,574 a ton, whereas the average grade was \$9,645 a ton, leaving a profit per ton of \$6,701.

In the long cross-cut which is being run to connect the new central shaft with the shaft which is being sunk on the Gillies claim near the Vipond boundary, two promising veins have already been cut. As these veins were not previously on any Hollinger charts they give promise of yielding an increase in ore reserves above any estimate. The completion of the cross-cut will take much time as it is a distance of 2,500 feet between points and only one drill is operating in the face.

The McIntyre-Extension shaft has now reached the thousand-foot level, a depth only attained by one other company in the Porcupine. From it, it is proposed to carry on all development on the McIntyre group which now includes the McIntyre, McIntyre-Extension, and McIntyre-Jupiter. The next development will be to commence the cross-cut to the No. 5 shaft where work on the lower levels is already congested. It is a distance of about 800 feet, so that it will be some time before it is completed. To the north of No. 5 shaft drifting on the 500 and 600 ft. levels is confirming the diamond drill work done here early in the year. The orebody where first encountered was 20 ft. wide from the foot wall. It ran about thirty dollars to the ton for about ten feet, but the quartz in the remainder of the orebody ran quite low. Intrusions of schist are now beginning to appear in this quartz and as they do so, the values grow. The vein is also opened up on the 600 ft. level. The building to house the additional machinery to be installed at the McIntyre mill has been completed some time, also the Dorr machinery for the cyanide mill has arrived, but delivery of the tube mills and ball mills is not satisfactory and it may be some time before the addition to the mill is running, in consequence of this delay.

Jupiter.—Progress in making ready the Jupiter to be a producing mine once more is marked. In B shaft a raise has been holed through from the 300 to 200 ft. level. The mine is also being re-surveyed and there is no doubt that mining should be well under way by the first of February.

Dome Lake.—There is some interest among mill men in the new process of cyanidation to be used at the Dome Lake mill. Without going into details it might be stated that a Detroit company proposes to treat the tails from the present mill in a large rotary drum. They claim for this process that it will make good extraction in four hours instead of 17 to 18 hours, and that the costs will be low. The Dome Lake mill is not making any payment on machinery or under any obligation in any way until it has been shown to be successful. The company guarantees to obtain a 95 per cent. extraction, otherwise they will not claim anything for their installation.

Burns Claims.—The little two-stamp mill which has been erected on the Tommie Burns claims in Shaw is now running. The same syndicate of working miners which made a success of their lease on the Gold Reef formed a company known as the Excelsior Mining Company. After the expiry of their lease on the Gold Reef they took up the lease on the Burns claims in Shaw and have now been working them for some time. They are sinking two shafts, one on a vein of quartz in which there is remarkable values in gold. This vein

s from one to two inches wide and as there is no sulphide ore in it, a good extraction should be made from the plate. The other shaft is being sunk on a big sulphide vein. There is a good deal of free gold in this vein, so that the operators hope to save quite a little from running this ore through the mill.

Jamieson.—Mr. Duncan Chisholm for his New York connections has taken over the Jamieson claims in Robb Township. These claims have been sampled more than once, but interest previously was not as keen in Porcupine prospects as to-day. The gold is found in quartz stringers over a quartz porphyry dyke about 200 feet wide. Mr. Chisholm has sent down a gang of eight or ten men and camps are being erected and surface work commenced, at once. The properties are about twenty miles from Timmins, near Kamiskotia Lake.

The Dome Extension Mining Company has overhauled its plant and commenced de-watering the mine. It is probable that one of the first operations undertaken will be diamond drilling near the Dome boundary. Recent development on the Dome has led to the belief that one of the Dome orebodies dips into the Dome-Extension at a depth of between 1,000 and 1,200 feet. Diamond drilling will be undertaken to ascertain if this is true, and to see if the orebody holds its value on the Extension side of the line.

New Companies at Porcupine.—There are prospects of several other companies starting up work in the Porcupine district in a very short time. Mr. A. M. Bilsky has recently been looking over the Apex for a Montreal company, with a view to seeing if it is desirable to open up the old property. It is understood that the American Goldfields will soon resume work on the claims in Tisdale. There are also reports that the Moneta Mining Company contemplate doing something on their properties adjoining the Miller Middleton. The Tisdale Mining Company is sinking a shaft near the Dome Lake line. It is certain that the West Dome contemplate opening up the old workings, but there is nothing definite as to when the actual de-watering will commence.

Demand for Prospects.—There is very great demand for Porcupine prospects and there is every indication that not only the producing properties in the centre of the camp will be busy this spring, but that many good prospects that have lain idle for years will be worked again.

COBALT, GOWGANDA AND SOUTH LORRAIN

The Nipissing had another unusually favorable month in regard to the discovery of new ore in December. The important discovery was on vein 490, on which a winze is being sunk on the fourth level. Until a depth of 75 ft. had been reached the vein was from three to eight inches in width and generally assayed low in silver values, running from 5 to 144 oz. At a depth of 75 ft. the vein was eight inches wide, very heavy in niccolite and a few feet assayed as high as seven or eight thousand oz. The next few feet found the vein faulted and low grade again, but geological conditions lead to the belief that it will hold more high grade ore.

At 80 shaft good ore was met with in the faulted extension of one of the branch veins at the 200 ft. level, about 50 ft. of an incline was driven on a vein averaging 2 in. in width and assayed 2,000 oz. Favorable results also continue in drifting on vein 102 at 96 tunnel. Ninety ft. of drifting has been done to date, in

which distance the vein assays better than 4,000 oz. over an average width of one and a half inches. Further development has been started with a view to finding the top of the ore shoot.

To make a base for operations to cut the Cobalt Lake fault vein surface buildings have been completed at S1 shaft. Sinking is now being prosecuted and will be carried on to a depth of 480 ft.

Actual production from the Nipissing for the month constituted a low record for the company for some years. The estimated value of the production during December was only \$112,907, whereas no previous production has fallen below \$164,846. On the other hand bullion shipped from the mine was higher, reaching \$379,642. But this was mostly customs ore, the Nipissing now being a very large purchaser of silver ore from other mining companies in the camp. The Nipissing stopes are now fuller than they have ever been in the history of the company and the discoveries of new orebodies at the Meyer shaft and under Cobalt Lake makes the future prospects brighter than for a long time.

McKinley.—While it is impossible to estimate ore reserves for more than six months at either the McKinley-Darragh or the Savage mines there is no doubt in the minds of those well acquainted with the old property that it will again be capable of surprises in 1916. The last annual report showed ore reserves of 55,176 tons and 12,835 tons for the Savage or a total of 68,011 tons. There has been milled during the year just past approximately 60,000 tons, so that there should be in sight less than 10,000 tons. As a matter of fact the tonnage is as great as at the beginning of 1915, though the silver content per ton is probably lower. No new orebodies have been found, but old orebodies have been discovered on lower levels and what was supposed to be the wall of the orebody has been discovered to be nothing more than a small barren block of ground on the other side of which there was good milling ore.

The blind vein at the 250 ft. level has been conducive of the most surprises. Estimates at the beginning of the year only gave ten feet below the 200 ft. level as likely to yield ore, but there is to-day a stope 35 ft. wide at the 250 ft. level on this vein. The Lake vein has also proved to be much less near exhaustion than was imagined and No. 20 on the 200 ft. level has yielded remarkably.

It was believed last year that the Savage would be worked out in 1915. Here again there have been no definitely new discoveries, but the old orebodies are being found to be much more extensive than any estimates gave them credit for. Some rich ore is now being taken out of a wide calcite vein in the old original shaft on the property. It was barren in the face as left for years, but a few shots discovered some rich high grade.

Chambers-Ferland still continues to make marked progress in the work at their shaft to the north of the town. All recent development has been from a winze sunk from the 300 ft. level. It was sunk on a strong vein of niccolite and smaltite carrying low silver values. This vein dipped out of the winze and it was necessary to cross-cut some 15 ft. before picking it up at a depth of 426 ft. It is here two to three and a half inches wide of ore that will run up to 3,000 oz. in silver. At the bottom of the winze there is an inch to an inch and a half of argentite ore. Eleven feet from the bottom of the winze there is an inch of smaltite ore running low in silver and 40 ft. away another inch vein

of high grade. A drift has now been pushed north-east on the main vein for about 40 ft. The experience in the Nipissing ground adjoining makes it most probable that there will be a big tonnage of mill ore between these various veins. An ore house is being built in which a sorting plant will be installed. Ore is already being sacked.

The Ophir Cobalt has been pumped out by the company and actual mining will soon commence under the direction of Mr. B. Neilly. The Silver Cliff has also been pumped out and sampled by the United States Smelting and Refining Co. and there are quite a number of other silver prospects being examined with a view to re-opening. The Genesee Mining Company operating the United States Cobalt prospect just north of the Hudson Bay, will start work again next week, Mr. Steenman, who is in charge of operations, returning from Rochester. The Coniagas Mining Company has purchased the Agaunico prospect on the shore of Lake Timiskaming near Haileybury and is now pumping it out before sampling.

The Flotation Process for the treatment of tailings in Cobalt has obtained a foothold in the camp. Experiments with the Callow process have been in progress for some time at the Buffalo mill and a small plant has been running on tailings for two months. The results are reported to be so satisfactory that several other companies in the camp are experimenting. In an annex to their low grade mill the Nipissing is installing a four unit plant for experimental purposes. It should be running very shortly. The McKinley-Darragh also has under consideration the installation of the process in connection with their water concentration mill and a contract has been drawn up for that purpose. Other companies have either tried or are now trying the process and it seems likely to meet with a fair measure of success.

NEWFOUNDLAND

Iron.—This winter promises to be the best mining season that Newfoundland ever enjoyed. The iron mines of the Dominion Iron and Steel Co., and of the Nova Scotia Steel Co., are to be worked all through the winter on an unprecedented scale. Till the beginning of the New Year, the activities that prevailed at the mines on Bell Island have during the winter been in a large measure preparatory to the great opening up that is now taking place.

With the Dominion Iron and Steel Co. mines Nos. 1, 2, 3, 4 and 5 are now being worked. This is the first time in the history of this company that these five mines have been worked together. Dominion No. 4 is practically a new mine, and little or no mineral has as yet been mined from it. The ore, however, has been thoroughly tested on this territory, and the quantity in which it is present as well as the quality has sufficiently warranted the grand scale on which this mine is now being opened.

Dominion No. 3, which has not been worked for eight years, and which was entirely filled with water, had to be pumped dry. This mine has a depth of roughly three thousand five hundred feet. It took one month to pump this mine, which meant an expenditure of perhaps \$15,000. In addition to this the several surface mines of the company are being all worked, so that the daily output surpasses anything ever attained before.

With the Nova Scotia Steel Co. work is also being resumed on something approaching the old scale of

operations. 1915 has been no doubt the "off" year in the history of the Nova Scotia Co. in Newfoundland. For the year the company shipped 188,260 tons of ore, and employed 450 workmen. Of the amount shipped 64,000 tons had been mined the year previous.

Since the opening of the New Year, however, there is every indication, judging from the increased activity displayed, that during 1916 the output from the mines of this company will approach 500,000 tons of iron ore.

Copper.—The Cape Copper mine at Tilt Cove, Notre Dame Bay is now working at a fairly good clip. More than one hundred men are employed at this mine at the present time. The last shipment of ore from this mine for this season has just left the coast. The shipment was taken by the S. S. Newfoundland, and is consigned to New York.

At the Baie Verte copper mine work is now progressing favorably; operations are to be continued through the winter. The stock pile that has already grown to a considerable size will be shipped away to English and American markets as soon as navigation opens in the spring.

The limestone quarries owned and operated by the Dominion Iron and Steel Co. for the past number of years in connection with the smelting of its iron ore has been completely closed down. All the employees have therefore left the limestone district, and found employment elsewhere.

The quarries, we understand, are to remain inoperative till the opening of the spring.

Electric Smelter.—Work is about to begin on a new electric smelter, to be established at St. John's, near the plant of the Reid Newfoundland Co. Mr. W. A. Mackay who is promoting the scheme has received from the municipal authorities at St. John's the necessary permit to the construction of such a plant. The electric power for the smelter will be secured from the Reid Company's power station at Petty Harbor.

Building Slate.—As there is likely to be a good demand for building slate after the war, for some time past much negotiation has been made for the purchase of some of the slate quarries of this country. The slate quarries of Newfoundland are large and of a very fine quality, and at intervals have been worked for years.

The Government Geological Survey of Newfoundland made by James P. Howley, F.G.S., in 1909, has this to say of the slate quarries of the country: "The slate of this country is of a superior quality, and has been pronounced equal to that of Wales by those competent to judge. It fetches in the English markets the highest price of any imported slate. It is an abundant material and is found in large deposits on the eastern and western sides of the island. Most of this slate is of a dark purple color, but some of it is reddish, and also some of an unfading pea-green color. It is said to be the best slate in America."

During the short intervals that these quarries have been worked to date 153,702 squares of roofing slate have been manufactured at the quarries.

Thomas L. Wilson, the promoter of the Newfoundland Products Co., died in New York Dec. 23rd. Mr. Wilson, who has been best known as "Carbide" Wilson, came to Newfoundland last year and was instrumental in putting through the House of Assembly one of the most gigantic schemes for the development of some of Newfoundland's mineral resources ever attempted.

This scheme was for the manufacture of the fertilizer ammonium sulphate. The construction of this plant was to involve an expenditure of twenty-one million

dollars. At the time of his death Mr. Wilson was in New York in connection with the financing of this corporation, and had met with excellent success.

A sketch of this scheme and what it entails was published in the number of the Canadian Mining Journal dated Dec. 1st, 1915.

As the work of construction of the plant of the corporation has been begun and great expenditures of money have been made already, in connection with the surveying of the territories which the corporation owns, the Reid Newfoundland Co., who are very largely interested in the scheme, does not anticipate that the work will be discontinued, although activities will no doubt be postponed somewhat by the sudden demise of Mr. Wilson.

At the present time a coal famine prevails at St. John's. Coal is selling for \$8.00 per ton, and in a few days it is expected that the price will go much higher.

A Mr. Snow of the district of Trinity Bay made last month what promises to become a most valuable gold find. Mr. Snow is a fisherman of that district, and the find was purely by accident. Several samples were recently subjected to an assay, the yield of gold was large, and in the spring a commencement of operations on the find is authoritatively spoken of.

The steatite for the lining of the furnaces of the smelter now being erected by Mr. W. A. Mackay is now landing from steamer at St. John's. This material has been imported from America.

THE WORLD'S DEEPEST MINE.

Where is the deepest mine in the world? That is a question very few people in this country can answer correctly. Even most mining experts would probably make a wrong guess—unless they had made rather exhaustive inquiries anent the subject—for it is located in a section of the world where you would least expect to find it. In the forests which cover the hills that cluster about the mouth of the mine wild monkeys are chattering and jumping about from limb to limb of the graceful palms which afford them food as well as shelter, while among the bright-hued flowers exquisite orchids waft their perfume and display their beauty for the benefit of these impish progenitors of man. Birds of rare plumage flit in and out among the shadows and the gorgeous red-blue-yellow macaws add their raucous voices to the medley of sounds, while splendid butterflies wave their large wings of iridescent blue and green and gold to enhance the riot of color in these tropic realms.

Tropic realms? Verily, for the deepest mine—gold or of any other metal—is located in Brazil. It is near a place bearing the euphonious name of Villa Nova de Lima, in the State of Minas Geraes, about 330 miles north of Rio de Janeiro. It has been worked, more or less systematically, for something over 80 years, and yet few of us have ever heard of the place, much less of the mine, which is known as the Morro Velho and is owned and operated by an English company.

Last year two young professors of geology, Benjamin Le Roy Miller, of Lehigh University, and Joseph T. Singewald, Jr., of Johns Hopkins, struck out for foreign parts and wended their way even into the hidden recesses of South America with the view of finding out something in regard to the mineral resources of the western hemisphere. They investigated almost all of the known mining districts of the southern continent and brought back with them a vast store of in-

formation relative to the mineral wealth of the various countries visited. In Brazil they visited this unusual and in some respects unrivalled gold mine. They tell about it in an article in the December number of the Bulletin of the Pan-American Union (Washington, D.C.), from which the following facts are taken.

The Morro Velho mine is located in the gold belt of Brazil, where the Portuguese were first induced to settle by the discovery of the yellow metal. The first gold was discovered in 1699 near the present city of Ouro Preto. The gold was coated with a black substance and hence was called "ouro preto"—black gold. The city which they founded was long called Villa Rica de Ouro Petro—the Rich City of Black Gold—a name which was somewhat cumbersome even for the Portuguese, so they finally shortened it to just Ouro Preto, the name by which it is known to-day.

Just when the Morro Velho mine was first opened is not known, but it was being operated toward the close of the 18th century, and considerable work had been done when the present company obtained control of it in 1834. The orebody consists of a great vein of unusual persistence and regularity that dips at an angle of about 45 degrees. It may be likened to a gigantic knife blade, held vertically and thrust into the earth at this angle with the point still lower than the present deepest workings. The combined depths of the connected shafts give a total of 5,824 feet. In other words, here is a gold mine that is being worked at a depth of more than a mile below the surface of the earth. Now be it remembered that the rock temperatures increase as the earth's crust is penetrated, in some regions the increase being as much as 1 degree F. for each 50 to 60 feet increase in depth. At this rate the temperature at the bottom of this mine would be over 100 degrees higher than at the surface, and fried ham and eggs might be prepared for the miners without any other heating apparatus than the loose rocks lying about. Incidentally the miners would be going through the frying process, too. Fortunately, however, in this mine the rate of increase of temperature is only 1 degree for every 100 to 120 feet, giving the rocks a temperature of only 112 degrees. By forcing cool air down into the mine by means of fans the temperature is lowered to a little less than 100 degrees. Even at that it is rather snug, and the miners usually wear only shoes, donning trousers when company is expected. Still, the mine has produced a total of about \$55,000,000 worth of gold, and is being worked now at a profit of something over \$700,000 annually.

SILVER PRICES.

	New York cents.	London pence.
December, 1915—		
23	54	25½
24	53¾	25¾
27	53¾	Holiday
28	54½	25¾
29	54¾	26
30	54¾	26⅞
31	55	26¼
January, 1916—		
3	55¾	26½
4	56½	26¾
5	56½	26¾
6	56¾	26¾
7	56¾	26½

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto.)

January 10th, 1916.

New York Curb.

	Bid.	Ask.
Am. Brit. Mfg.	18.00	25.00
Atlanta.	.22	.23
Canada Copper	1.93¾	2.00
Chevrolet Motors (U. S.)	125.00	128.00
Am. Marconi	3.50	3.75
Belmont.	4.50	4.75
Goldfields Cons.	1.06¼	....
Jim Butler	1.09¾	1.15¾
Jumbo Extension	1.31¼	1.37¼
Standard Oil & Lead (B.C.)	1.81¼	1.93¾
Stewart Mining	.50	.56¼
Tonopah Extension	4.00	4.06¼
Tonopah Merger	.55	.60
Tonopah Mining	6.87½	7.12½
Victoria Oil	2.25	2.50
West End Cons.	.78	.80
Anglo-Amer. Oil	17.50	18.00
Standard Motors	9.25	9.75
Submarine Corp.	41.00	41.50
Maxim Munitions	11.75	12.25
Standard Oil of N. Y.	217.00	220.00
Standard Oil of N. J.	515.00	520.00
Standard Oil (old)	1660.00	....
Standard Oil (subs)	1150.00	....

Porcupine Stocks.

	Bid.	Ask.
Apex.	.08¾	.08¾
Dome Consolidated	.24½	.25
Dome Extension	.37½	.38
Dome Lake	.28	.28½
Dome Mines	28.25	29.00
Eldorado.	.00¾	.00½
Foley O'Brien	.60	1.00
Gold Reef	.02¼	.03
Hollinger	29.00	29.50
Homestakes.	.37	..
Jupiter	.22½	.22½
McIntyre	1.01	1.02
McIntyre Extension	.29¼	.30
Moneta	.14	.14½
Porcupine Crown	.84½	.86
Porcupine Imperial	.05	.05¼
Porcupine Tisdale	.02¾	.03
Porcupine Vipond	.73	.75
Preston East Dome	.06½	.06¾
Teck Hughes	.21½	.22½
West Dome	.16½	.16¾

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.04¾	.05½
Beaver	.44	.44½
Buffalo	..	.95
Chambers Ferland	.30¼	.30¾
Coniagas	4.85	..
Crown Reserve	.52½	.54
Foster	.05	.07
Gifford	.08	.08¼
Gould	.00¾	.01
Great Northern	.04	.04½
Hargraves	.05¾	.05¾
Hudson Bay	25.00	..
Kerr Lake	4.35	4.65
La Rose	.63	.68

McKinley	.43	.46
Nipissing	7.50	7.75
Ophir.	.09¾	.10
Peterson Lake	.37¼	.37½
Right of Way	.07	.07½
Seneca Superior	.65	.75
Shamrock Cons.	.18¼	.19¼
Silver Leaf	.02¾	.03½
Temiskaming	.70	.70½
Trethewey	.18	.19
York Ontario	.01¾	.02
Wettlaufer	.08	.09

NEW YORK MARKETS.

Jan. 7.—Connellsville Coke—

Furnace, prompt, \$3.00 per ton.

1st half, \$2.35 to \$2.50; year 1916, \$2.25 to \$2.35. per ton.

Foundry, prompt, \$3.50 to \$4.00 per ton.

Foundry, contract, \$3.00 to \$3.25 per ton.

Jan. 7, 1916.—Straits Tin, f.o.b., nominal, 41.75 cents.

Copper—

Prime Lake, nominal, 23.25 to 23.75 cents.

Electrolytic, nominal, 23.25 to 23.75 cents.

Casting, nominal, 22.25 to 22.75 cents.

Lead, Trust price, 5.90 cents.

Lead, outside, 5.90 cents.

Spelter, prompt western shipment, 17.42½ cents.

Antimony—

English brands, nominal.

American, 42.50 cents.

Chinese and Japanese, 42.50 cents.

Aluminum—

No. 1 Virgin, 98-99 per cent., 54.00 to 56.00 cents.

Pure, 98-99 per cent. remelt, 53.00 to 55.00 cents.

No. 12 alloy remelt, 44.00 to 46.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, \$175.00.

Platinum—Nominal, \$88.00 to \$100.00.

Cobalt (metallic), \$1.25.

Silver (official), 56¾ cents.

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 30.00 cents.

Copper wire, base, 24.75 to 25.25 cents.

High sheet brass, base, 33.00 to 35.00 cents.

Seamless brass tubing, 36.00 to 38.00 cents.

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Brass wire, 33.00 to 35.00 cents.

Brass rods, 33.00 to 35.00.

Sheet zinc, f.o.b. smelter, 23.00 cents.

TORONTO MARKETS.

Jan. 11, 1916—(Quotations from Canada Metal Co., Toronto)

Spelter, 21 cents per lb.

Lead, 7¼ cents per lb.

Tin, 42 cents per lb.

Antimony, 48 cents per lb.

Copper casting, 22¼ cents per lb.

Electrolytic, 22¾ cents per lb.

Ingot brass, yellow, 13c.; red, 15c. per lb.

Jan. 11, 1916—(Quotations from Elias Rogers Co., Toronto)

Coal, anthracite, \$8.00 per ton.

Coal, bituminous, \$5.25 per ton.

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MAPS:

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NEW BRUNSWICK AND NOVA SCOTIA

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Map 39A. Geological Map of Nova Scotia.

QUEBEC

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Map 100A. Bell River, Quebec. Geology.

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Map 72A. Saanich sheet, Vancouver Island. Geology.

Map 143A. Shuswap Lake, Kamloops District, B.C. Geology.

YUKON AND NORTH-WEST TERRITORIES

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Map 122A. Upper White River District, Yukon Territory. Topography.

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TORONTO

No. 3

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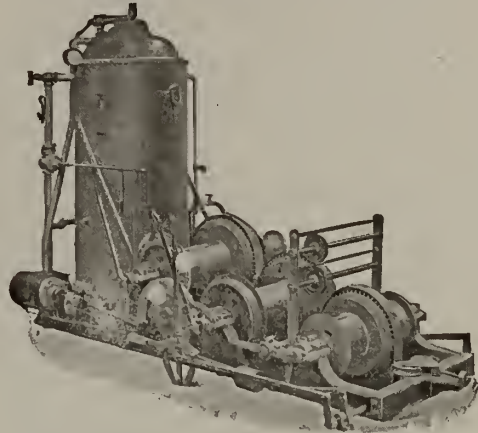
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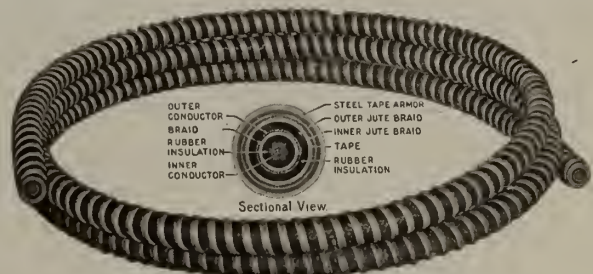
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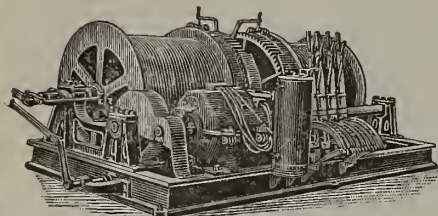
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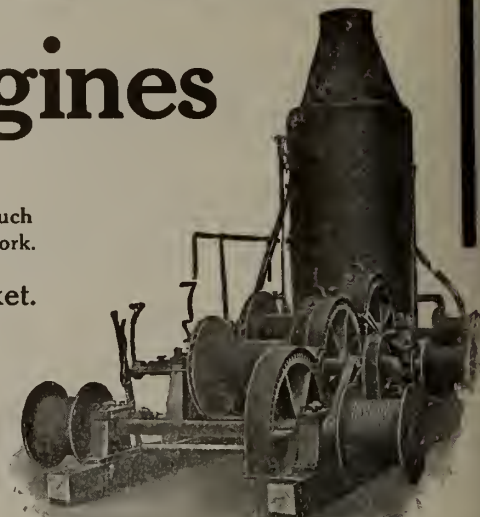
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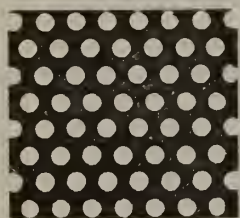
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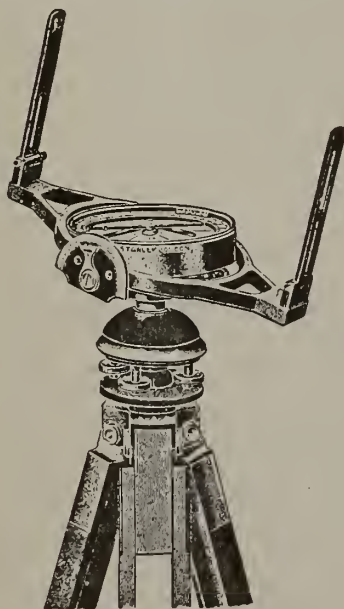
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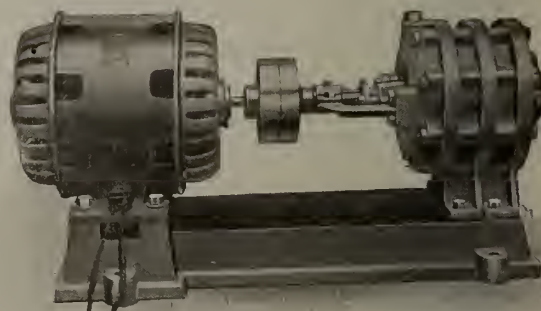
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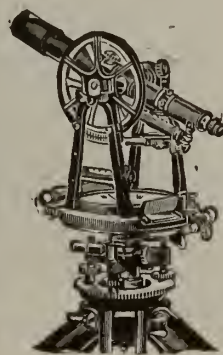
1. Four Year's Course for a Degree (B.Sc.) in
 - (a) Mining Engineering.
 - (b) Analytical and Applied Chemistry.
 - (c) Mineralogy and Geology.
 - (d) Chemical and Metallurgical Engineering.
 - (e) Civil Engineering.
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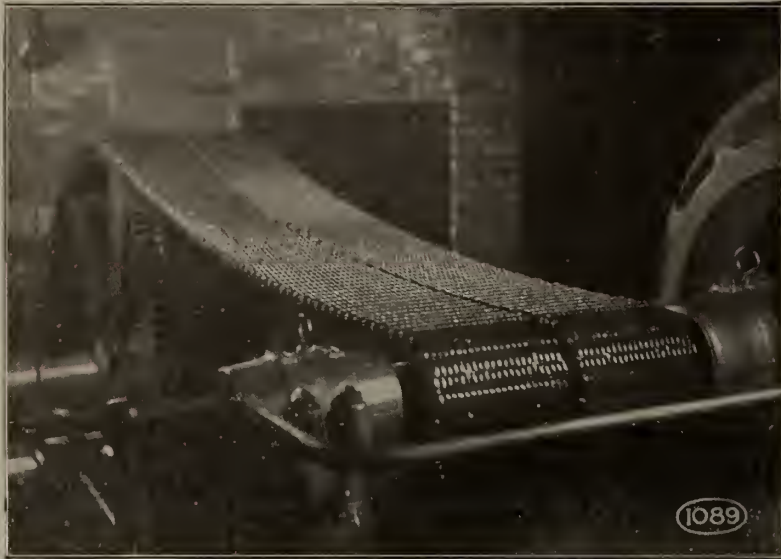
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Yours truly,

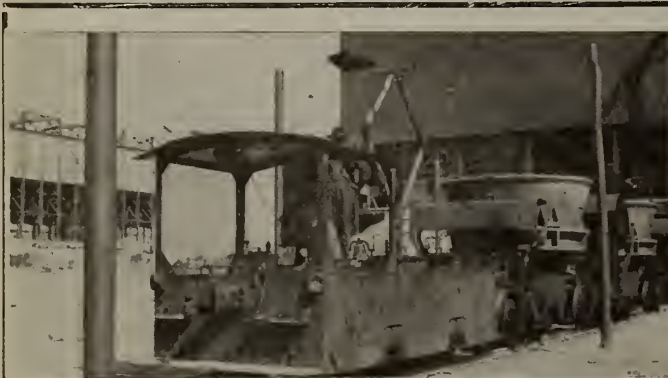
The above comes from a prominent Cobalt Mining Co (name on application) and is signed by the Manager.

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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, February 1, 1916.

No. 3

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REGINALD E. HORE

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A NICKEL REFINERY FOR CANADA

The nickel question is up again. It was the chief topic of discussion at the meeting of the Toronto branch of the Canadian Mining Institute on Saturday, January 15. A few days later the interest of the general public was revived by newspaper reports to the effect that the refining of nickel in Canada is likely to be undertaken at an early date. We hope that these reports will prove well founded. In view of the circumstances they seem not unlikely to be so.

On January 19 the following item appeared in a Boston financial paper: "Canada's resolution to refine its own production of nickel is endorsed by International Nickel Co., who declare they will undoubtedly, when the time comes, erect refinery there to work on the 80 per cent. of world's nickel supply which Canada produces. International Co. now refines three-fourths of it."

On January 22 the same paper published the following: "International Nickel Co. has decided to erect a nickel refinery in Canada. In this respect it is stated that the company desires to co-operate with the Canadian Government in its desire to have some of the nickel ore mined in the Sudbury district of Canada refined in the Dominion. Pres. Monell recently returned from Canada after conferring with officials of the Dominion. The arrangement is said to be satisfactory to both the Canadian Government and the company."

About the same time Ottawa correspondents of Toronto papers sent out news items on the same subject. The Toronto World, which is largely responsible for the great public interest in the nickel question, had in its issue of January 21 the following item from a staff reporter at Ottawa:

"Negotiations are almost completed for the establishment of a nickel refinery in Canada by the International Nickel Company, which has control of the Sudbury nickel mines. The refinery will be situated in Cape Breton, N.S., and henceforward all the nickel material which has hitherto gone to New Jersey for refining will be refined in Canada. The export of nickel from Canada is to be controlled completely by the Government in order to insure a steady supply for the allies for the manufacture of armaments for field and naval purposes, and to render it certain that no Canadian nickel will find its way to the enemy."

Under the same date The Globe published the following: "The recent visit to Ottawa of Mr. Ambrose Monell, the creator of the International Nickel Company and the industry which it represents, has resulted in the announcement that arrangements have been made whereby the final processes of refining nickel in Canada will be

completed in this country by the corporation of which Mr. Monell is the moving spirit. It is reported that an understanding has been reached between the Dominion Government and the International Nickel Company whereby a nickel refinery will be established on the Atlantic seaboard. This departure is understood to be dictated entirely by economic conditions, the destination of the output of the Ontario nickel mines never having been the cause of any anxiety to the Government of either Canada or Great Britain. Since the war began, there has been close co-operation between the International Nickel Corporation and the British War Office and largely through the increased activity of the Canadian nickel mines the requirements of Great Britain and her allies have been satisfied. The new arrangement, however, will mean an important addition to the list of industries which will be opened somewhere near the time that peace is declared."

Other newspapers have published similar statements concerning the significance of Mr. Monell's visit to Ottawa, all accepting as plausible the report that a refinery will be established in Canada; but differing widely in opinion as to why and when it will be established and what part of the nickel matte produced will be refined here.

According to the Boston News Bureau of January 19 the International Nickel Company will erect a refinery in Canada—"when the time comes." We are naturally interested in knowing what is meant by this significant phrase. Does it mean that the company expects the Canadian Government to insist on refining being done here? Apparently it does. Does it mean that all the refining will have to be done here? On this point the reports vary, one answers the question affirmatively and the other negatively.

The Toronto World, which invited our hostile criticism by demanding a year ago an embargo on the export of nickel matte to the United States, seems to interpret the news item as an indication of the Government's dissatisfaction with the present arrangements for preventing nickel from reaching the enemy. It may be true that some Canadian nickel is reaching Germany; but if so a great many people whose business it is to know what is going on are being grossly deceived. We have had no good reason yet to conclude that such is the case. It is obvious that Germany has been making every attempt to procure nickel and she may have succeeded in some cases. The British Admiralty is, however, in a position to secure necessary information in this connection and the Government has reported that present arrangements are satisfactory.

It is possible that since the Government assurances were given that control of export has been lost and that nickel is now reaching the enemy. It may be that the Government has obtained reliable information of such traffic and has determined to insist on all the refining being done here. We have no information to this effect, however, and consider it quite unlikely.

While we disagree with the World concerning this phase of the nickel question we agree with its contention that steps should be taken to have the refining done in Canada. It is obviously to the advantage of Canada and the mining industry that we should send out finished rather than raw materials. We would rather export nickel than nickel matte; further, we would like to export nickel steel instead of nickel for the manufacture elsewhere of nickel steel and we would prefer to export nickel-plated articles instead of nickel for plating.

We agree also with the World that it is regrettable that in a time like the present we are dependent on a foreign plant for the production of refined nickel. We take issue on the question of how this condition should be remedied. The World seems unwilling to believe that the International Nickel Company is not exploiting Canada in the interests of Germany. We prefer to believe that the company is in business primarily to make money, and that the directors consider the present arrangements satisfactory on account of business reasons and not from a desire to deprive Canada of an industry or to further the interests of Germany.

We have therefore expressed in these columns satisfaction with the present arrangements as being in the best interests of Canada and of the company. By placing an embargo on nickel matte we would be depriving the Empire and a friendly country of needed supplies. By failing to take precautions satisfactory to the British Admiralty for preventing nickel from reaching our enemy, the International Nickel Company would put itself in a position which would force Canada to prohibit the export of nickel matte to the United States. It is obvious that the company is not anxious to bring about such a condition of affairs.

We have also expressed on former occasions a desire to see nickel refineries established here if such a change can be made without unfairly treating the company which is chiefly responsible for the existence of Canada's nickel industry. It is not unlikely that the company would be willing to make some concessions in view of the large profits that are being made and of the feeling in Canada with regard to the question, and we imagine that the company could establish a refinery in Canada and still be able to pay dividends. We consider, however, that there should be more disposition to meet the company half way and we have no sympathy with the demand that the company be forced to abandon its New Jersey plants.

In the Globe's comment, quoted above, it is hinted that a nickel refinery will be established about the time that peace is declared. The authority for that statement is not given by the Globe. Is there any connection between these remarks and the statement in the Boston News Bureau that a nickel refinery will be established in Canada "when the time comes?"

We fail to see why the end of the war should be chosen as the time for adding to Canada's industries. To our mind the time is now. The demand for nickel and copper was never so great as to-day. The output of the

Sudbury district was never so large. It is evident that if the increased demand is to be met by increased production there must be increase in plant. If there is to be increase in plant, is not now the time to begin construction of a refinery in Canada? It could take care of the new business and gradually be extended to meet the demands for increased output which is bound to come. The New Jersey plant, instead of being scrapped, could be used to supply part of the market under the present restrictions. Before the time comes for the lifting of the present restrictions consideration should be given to the advisability of providing that the New Jersey plant should be used only for supplying the United States market.

THAT COPPER RULING

News despatches recently have credited the British Government with making a rule that the price of copper must not exceed £100 per ton—equal to about 21 cents per pound. Naturally there have been adverse comments on what appears an arbitrary measure to fix the price of a commodity which England must obtain abroad and chiefly in the United States.

As the Journal of Commerce points out, such a ruling might prevent British munitions manufacturers from obtaining copper. "In that case the British factories will have to close, and the orders for munitions will have to be sent to the United States and Canada, where manufacturers are free to buy their copper in such quantities and at such prices as the market conditions may allow. Such a result would not meet the purposes which the Government had in view. They desired to guard against the excessive price of an article absolutely necessary in the production of munitions. They may have to come to the conclusion that it is better to have copper at a high price than not to have it at all."

The wording of the ruling is, however, worthy of consideration. It states that no order should be placed at prices exceeding £100 per ton "without first consulting the director of materials." The news despatches have omitted these significant words.

CANADIAN MINING INSTITUTE

There is to be no election of officers at the meeting of the Canadian Mining Institute in March, but there are indications that the business session will be enlivened by discussions on the by-laws. At least two amendments have been drawn up and submitted for consideration at the meeting.

One of these amendments would provide that certain matters now decided at the annual meetings should be decided by letter ballot. From what we have heard of this proposal it is apparently the opinion of Mr. Norman Fisher and Mr. B. Neilly, who are proposing this amendment, that the present method is unfair to the large number of members who are unable to attend the meet-

ings and are thus deprived of a vote. Most of us agree with them in this. It is generally acknowledged that there are good grounds for dissatisfaction with the present practice. Many members live so far from the places of meeting that they are seldom able to attend. It is not desirable that they should be deprived of an opportunity to vote on some of the questions which are now decided at the annual meetings. On the other hand the business sessions would lose most of their interest if questions of importance could not be decided there. Most of the members who attend the business sessions do so because something is to be decided there and because they want to hear or take part in the discussion. If no decision was to be arrived at the session would lose nine-tenths of its interest. The proposal merits consideration. It is not an easy matter to decide which method of voting is in the best interests of the Institute.

The Temiskaming Mining Company directors have a particularly interesting report to present at the annual meeting, the date of which has not yet been set. The year 1915 was a very successful one and the prospects are even better, for important additions have been made to ore reserves. President F. L. Culver deserves great credit for the able manner in which he has handled the company's affairs.

The excellent inspection system at the Beaver mine has attracted much attention. Numerous favorable comments have been made on it and the Chief Inspector of Mines of Ontario, Mr. T. F. Sutherland, has pointed it out many times as a good example. A recent publication of the U. S. Bureau of Mines pays the management of the Beaver a well deserved compliment by singling out the Beaver system as the best in America for a small mine.

The Nova Scotia Steel and Coal Co. has decided to enlarge the plant at New Glasgow. A new open hearth furnace of 200 tons capacity and a plant for forging shells have been contracted for.

American mining companies paid in dividends in 1915 the sum of \$75,383,387 as compared with \$60,323,529 in 1914.

Deep in the German mind was the sentiment that robbery is not robbery when Germans steal for Germany; deep in the German mind was the sentiment that to get by force is as good a way as any. So, having got by industry what was to be had, Germany has published her creed: "Property first, righteousness at convenience." We have all seen the document sealed with blood of Belgium. We have all accepted notice that Germany is for Germany, property first, and all of us who are not Germans admit that Germany on her present basis is of all the nations the most powerful enemy of peace.—Life.

INTERNATIONAL NICKEL CO.

New York, Jan. 26.

International Nickel Co. in the three months ended Dec. 31 earned 6.8 per cent. on \$41,834,600 common stock, and in the nine months ended Dec. 31 earned 19.4 per cent. on the same amount of stock.

The following tabulation shows the income account for the three and nine months periods ended Dec. 31, 1915:

	Three mos. end. Dec. 31	Nine mos. end. Dec. 31
Gross.	\$3,541,776	\$10,209,531
Other income	65,496	168,449
Total income.	3,607,272	10,377,980
Administration and gen. exp.	184,026	636,152
Net income	3,423,246	9,741,828
Depreciation, mineral exhaust.	464,704	1,215,867
Surplus.	2,958,541	8,525,960
Preferred dividend	133,689	401,067
Balance for common	2,824,852	8,124,893
Per cent. on common	6.8	19.4
Common dividend	2,091,730	3,993,305
Surplus.	733,122	4,131,588

In three months ended Dec. 31, International Nickel Co. had a balance equivalent to about 7 per cent. on the common stock, or at rate of 28 per cent. for the year. This takes into consideration the stock issued in payment of the 10 per cent. stock dividend.

In the first nine months of the current fiscal year, after allowing all charges for depreciation, mineral exhaustion, and preferred dividends, the company earned about 20 per cent. on the increased common stock. Thus the full year's cash dividends were earned in nine months.

Gross in quarter ended with December was greater than any previous quarter. The current quarter is expected to show even a bigger gross. It is expected that last half of the fiscal year will show gross fully 50 per cent. in excess of the first six months, with a commensurate gain in balance for dividends.

Cash balance at close of the fiscal year, March 31, if no extra dividend is charged out in the meantime, will approximate 25 per cent. on the common. There is every reason to believe common shareholders will receive a substantial extra cash dividend in the near future.

REFINING AND USES OF NICKEL

In "The Globe," Toronto, under date of Jan. 21, is an interesting unsigned contribution on nickel. We print it below with a few changes which have been made to correct what are obviously typographical errors:

The establishment of a nickel refining plant in Canada will be a considerable economic problem, as it will entail increased cost of sulphur—sulphur-free, free oils, coke, nitre cake, fire brick, fire clay, magnesite brick and coal. Until now the refining has been done at Bayonne, New Jersey, adjacent to the great oil refineries and chemical plants.

In the ordinary process the ore mined in the Sudbury district by the International Nickel Co. is transported to the smelter at Copper Cliff, and is there smelted by successive stages into a product known as copper-nickel matte, containing approximately 55 per cent. nickel, 25 per cent. copper and 20 per cent. sulphur. All of this matte has been shipped to the Bayonne refinery, where the nickel and copper have been separated from each other, the copper being advanced

to the form of electrolytic copper and sold in the market.

The shipment of nickel matte is analogous to that condition existing throughout the copper industry of the United States, in which it is the general practice for the copper producers to bring their products to the stage known as blister copper at a smelter close to their mines, and then transport the blister copper to some central refinery, advantageously situated where the supplies and the power necessary for its economical subsequent refining into a marketable product are cheap, in many cases this distance being thousands of miles.

Nickel, after being separated from the copper, is refined to a high degree of purity, of approximately 99 per cent., and sold to consumers in the United States, Canada and foreign countries.

Nickel is not sold by the company in the form of a finished article of merchandise reaching consumers directly. It is in the form of a crude metal that is alloyed with other metals and then fabricated into ingots, bars, sheets, strips and other similar metallic products, from which a finished article that reaches the consumer is made. Contrary to general belief, nickel production no longer depends upon naval armaments or martial requirements. Nickel steel in varied forms is used in a wide range of industrial operations, as well as in the manufacture of ordnance and projectiles.

The property of toughness which nickel imparts to steel has rendered its adoption for industrial purposes of expanding importance. Large quantities of plate were used in connection with the reconstruction of the Quebec bridge; the construction of the Manhattan and Queensborough bridges in New York city; the St. Louis bridge over the Mississippi; the Kansas City viaduct and bridge over the Missouri; the Emergency dam, locks and spillway in the Panama Canal, and in many other smaller structures. Nickel has entered into all sorts of railway materials, marine engines and propeller shafts, and a thousand and one lines of manufacturing trades. Armor plate, protective deck plates, large and small guns, armor piercing projectiles, gun shields, etc., contain nickel, but they constitute a small portion of the market for the metal. Manufacturers of alloyed metals—German silver manufactures, for example—cover a large field. In their products, copper-nickel and zinc form component parts. These alloys vary in their nickel contents according to their uses and to the whiteness and softness of the metal to be produced. They enter into hardware and plumbing supplies, tableware, dairy machinery, railway car fittings, electrical resistance materials, cartridge shells, bullet jackets and coinage; both in German silver and pure nickel. The non-corrosive qualities of pure nickel make it specially desirable for cooking utensils, surgical instruments and like purposes. Monel metal—the natural nickel-copper alloy, has found a large market for many uses. Nickel was introduced into the manufacture of the Edison storage batteries, and is much sought in the automobile trade.

SILVER STOCKS IN NEW YORK

Boston, Jan. 21—Approximating 3,000,000 ounces of silver at New York and San Francisco represents the holdings of the silver sales agencies at the present time according to estimates of the best posted interests. In the closing months of 1915 the accumulation got as high as 7,000,000 ounces, but a spurt, which lasted about two weeks, took away about 4,000,000 ounces in that time. This metal was shipped abroad.

DOMINION COAL

The corrected totals of the Dominion Coal Company's production in 1915 are as follows. The production of 1914 is given for comparison.

	1915	1914
Glace Bay Collieries.....	4,608,979	4,287,717
Springhill Mines.....	400,791	417,406
	5,009,770	4,705,123

Increase over 1914: 304,647 tons.

The output for January will be around 390,000 tons from the Glace Bay mines and 38,000 tons from Springhill, comparing with 256,000 from Glace Bay and 31,000 from Springhill in January last. If these figures are realized the first month of 1916 will show an appreciation in production of over 140,000 tons compared with the first month of 1915. This large production has become possible because the collieries are working steadily every day, a very unusual condition in January. Last January the mines were working only intermittently, and at very little over half capacity.

Practically all the coal that is being mined is also being shipped, and only small quantities are being stored in banks.

Taking Nova Scotia as a whole the production and shipments in January 1916 will be the largest in the history of coal mining in the Province. It may also be remarked that it is the first time that the Nova Scotian collieries have been able to show what they could do in January, because for the first time, at this season of the year, the demand has been about equal to the supply.

BETHLEHEM STEEL

Bethlehem Steel common sold at \$600 in October, when predictions were freely made that the European war would be over by spring of this year.

It is now selling below \$500, with a \$30 dividend to come of this year, and prospects that there will be no termination of the war before fall. By that time Bethlehem Steel will have practically completed its present European contracts, in which case the most optimistic forecasts of earnings for 1916 will be realized. It means that Bethlehem will earn for its common stock this year \$400 a share or more.

If the European war continues into the latter part of the year, long before then the Bethlehem Co. will be deluged with another big batch of foreign war orders, and estimates of earnings for the year 1917 will be in order.

It is expected that 9,000,000 shells will be completed and delivered in the first ten months of this year. Estimating \$6 as profit per shell, earnings on these 9,000,000 shells alone would reach \$54,000,000.

With two months of the year to go, and profits from guns and other classes of ordnance, rails, structural and commercial steel, estimates of \$400 a share upward for the common in 1916 are not to be wondered at.

Pres. McGregor of Union Iron Works of San Francisco has been in New York consulting with Bethlehem Steel officials relative to enlargement of the Union plant, which is a subsidiary of Bethlehem Steel. Vice-Pres. Snyder of Bethlehem Steel Corporation has returned from inspection of the Union works.—Boston News Bureau.

HARGRAVES

According to a Toronto Mining Broker the Hargraves is under option to New York interests, with every chance of the deal being consummated early in February. The work on this property in the past has been chiefly on veins which were not highly productive. Some good ore was taken out near the Kerr Lake boundary.

U. S. OIL PRICES

Houston, Tex., Jan. 21—Magnolia Petroleum Co., Pierce-Fordyce Oil Association and Bonner Oil Co. advanced gasoline, tank wagon basis, and at filling stations, two cents a gallon to 19 and 21 cents, respectively. Kerosene prices have been advanced one cent a gallon to 12 cents, and naptha two cents a gallon to 17 cents, tank wagon basis.

Neither Gulf Refining Co. nor Texas Co. has raised prices to meet the new schedule, but both are expected to do so before the end of the week. Demand for all grades of oil is exceptionally strong. Cold weather apparently has no effect on consumption of gasoline, and all companies report a capacity business.

Independence, Kansas—Prairie Oil & Gas Co. advanced price of Mid-Continent crude 5 cents to \$1.25 a barrel.

INTERNATIONAL NICKEL

"International Nickel directors meet for action on the common dividend February 7, and it is expected that an extra dividend will be declared, in addition to the regular 5 per cent. Little credence is given in Wall Street to the report that the Canadian Government is contemplating action that would result in the company being forced to refine its ore in the Dominion. This question has been discussed several times, and the company has always succeeded in convincing officials of the economies that are possible in refining the ore at its Bayonne, N.J., plant. There are two reasons due to the war, why Canada might consider such a change. The first would be to prevent Great Britain's enemies from obtaining the metal which in its raw state, was produced in Canada. Second, to prevent an inflation in the price which would hinder its use in the production of munitions, automobiles and other necessities of war."—*Financial Times*.

APEX.

The shareholders of the Apex Mining Company at a meeting Monday, Jan. 24, in the offices of Sir Henry M. Pellatt, unanimously ratified a bylaw authorizing the directors to sell 699,991 shares of treasury stock at not less than 15c a share. The shareholders are to be given the privilege of subscribing pro rata to this issue up to Feb. 15. It was announced at the meeting by Mr. A. M. Bilsky, who presided, that a brokerage house in Montreal had signified its intention to deal along these lines for this block of stock.

BOSTON CREEK.

Boston Creek, Ont., Jan. 20—The Miller Independence Mining Syndicate has completed the installation of boiler and machinery and the work of getting the plant in shape is proceeding satisfactorily. Up to Saturday ten barrels of ore worth approximately \$15,000 was in the ore house.

It is reported here on good authority that the Richardson, Albright Papasimakes Mining and Development syndicate holdings have changed hands, the price being \$200,000.

ADANAC

An important strike at the Adanac mine, south west of the Temiskaming, is reported. According to the reports received rich ore was encountered in sinking a winze from the 200 ft. level.

TRIUMPH

The Triumph Mining Co., has taken over and is developing the Success company's property near the Vipond mine.

TABLE II.

Speiss Roasted in Edwards Furnace with 15% Salt. (Weights in Pounds)

No.	Weight of Speiss	Weight of Salt	Total Weight	Wt. After Roast	Gain in Weight	Assay Silver Before R.	Assay Silver After R.	Silver Content Before R.	Silver Content After R.	Oz Silver Lost	Per Cent Sil. Lost
1	10,000	1500	11500	12295	1195	1182.0	917.6	5910	5641		
	Weight of flue dust, clinker, etc			3176			115.0		183		
								5910	5824	86	1.46%
2	10000	1500	11500	13025	2525	1092.6	816.9	5463	5320		
	Weight of flue dust, clinker etc.			1146			164.7		94		
								5463	5414	49	0.90%
								11.373		135	1.18%

TABLE III.

Results of Three Months Test of Roasting Process

Speiss Charged to Roasters

Lot	Dry Weight	Co.	Ni.	Assay As.	Ag.	Cobalt	Nickel	Metallic Content Arsenic	Silver Oz.
212	43715	17.62	10.00	21.30	1648.43	7703	4372	9311	36039.30
213	69838	19.18	10.13	25.20	1293.00	13395	7095	17599	45150.27
214	53634	14.82	6.70	23.85	1962.65	7949	3593	12792	52632.39
215	68917	19.24	5.85	30.35	1653.43	13259	4031	20916	56974.71
216	33043	19.70	7.10	22.75	1702.45	6509	2346	7517	28127.03
217	51790	20.86	7.54	27.65	1436.71	10803	3905	14320	37203.61
218	48715	19.03	7.56	27.75	1472.16	9270	3683	13518	35858.14
219	31940	18.83	8.35	28.05	1292.30	6014	2667	8959	20638.03
220	12320	19.61	9.44	29.85	1556.18	2417	1164	3679	9590.74
221	10811	18.02	6.86	24.95	1598.17	1948	742	2611	8638.91
222	10757	17.97	7.77	23.65	1695.90	1933	836	2544	9121.40
223	41683	19.84	6.95	27.90	1788.80	8270	2897	11630	37281.28

377255.81

Credits for the above roasting; 9 lots of Chloro-Speiss shipped to Orford Copper Co., 3 lots of rejected Speiss, Flue Dust and Crude Arsenic.

156	38066	15.96	8.77	14.03	1334.50	6975	3338	5341	25399.54
157	56284	16.35	8.75	13.95	1189.90	9202	4925	7852	33401.74
158	46407	14.17	7.39	10.10	1534.20	6576	3429	4687	35598.81
159	49941	15.95	6.07	22.20	1365.90	7966	3031	11087	34107.21
160	44447	16.76	6.12	15.35	1525.40	7449	2720	6823	33899.73
Reject	50505	14.86	6.70	20.20	1329.10	7505	3384	10202	33562.07
161	52371	17.71	6.74	16.90	1360.30	9275	3530	8851	35633.23
162	50077	17.91	6.98	13.75	1304.37	8969	3495	6886	32658.82
163	49070	17.02	7.06	22.85	1240.30	8352	3464	11212	30430.76
164	41166	17.42	6.45	23.50	1544.80	7171	2655	9674	31796.62
Reject	46465	14.95	5.92	23.20	1197.70	6947	2751	10770	27825.57
Flue dust	3305	18.42	2.33	15.10	669.50	609	77	499	1106.35
Reject	30845	15.44	6.87	21.40	1267.30	4762	2119	6601	19544.93
Crude Ars.	16781	3.90	2.08	52.30	211.50	654	349	8771	1774.59

376140.97

Loss in Silver. 1114.84

Per cent loss. 0.29%

MINING IN BRITISH COLUMBIA IN 1915

By E. Jacobs.

The mining industry of British Columbia showed improvement in 1915 over results obtained in 1914. An estimate of total value of the mineral production of 1915 places the amount at \$29,979,000, as compared with \$26,388,825, which was the revised total on official record of the value of the production of 1914. The increase in value, therefore, appears to have been \$3,490,175. However, since there were differences in average prices of some of the metals, this does not show the actual position, which is better indicated in the table that follows, giving the estimated quantities of minerals produced (save only as to miscellaneous products) and exhibiting the year's changes in totals of production of individual minerals.

Estimated Mineral Production of British Columbia in 1915.

Mineral.	Quantity.	Increase or Decrease over 1914.
Gold, placer	oz. 34,500	I. 6,250
Gold, lode	oz. 257,690	I. 10,520
Silver	oz. 3,670,144	I. 67,964
Lead	lb. 45,306,000	D. 5,319,043
Copper	lb. 57,382,294	I. 2,372,595
Zinc	lb. 11,940,000	I. 4,073,533
Coal	tons, 2240 lb. 1,552,000	D. 258,967
Coke	tons, 2240 lb. 248,424	I. 13,827
Miscellaneous products	\$2,000,000	D. \$ 852,917

As the year 1914 was not an ordinary one, for the reason that war conditions brought about the closing in August of many metalliferous mines, some of which were operated during the greater part of 1915, the comparison of results obtained in those years respectively, is hardly a fair one. On the other hand the general position was much more favorable in 1913, so that comparison with that year's production would also be on inequitable basis, in this case against 1915. Yet, this notwithstanding, the following changes in 1915 as compared with 1913 may be stated. Placer gold I. 9000 oz.; lode gold, D. 14,564 oz.; silver, I. 204,288 oz.; lead, D. 10,058,677 lb.; copper, I. 10,921,989 lb.; zinc, I. 5,181,232 lb.; coal, D. 585,483 tons; coke, D. 37,621 tons; miscellaneous products, D. \$1,198,100. While these figures show that there were several large decreases, there were substantial increases in other minerals that in point of money value went far to compensate for the decreases, so that, on the whole, last year does not suffer very much by this second comparison.

Gold. Of the total of 34,500 oz. of placer gold from the whole province, the proportion credited to Cariboo district is 13,750 oz. and that to Cassiar district 18,500 oz., of which latter 17,000 oz. is estimated as Atlin's share and 1500 oz. that of Liard and Stikine divisions of Cassiar. Of the remaining 2250 oz., the apportionment is 500 oz. to Fort Steele division of East Kootenay; 400 oz. each to Omineca and Similkameen; 250 oz. each to Lillooet and Nelson; and 450 oz. is the total of several smaller producers.

Lode gold came in largest part from Rossland mines, which are estimated to have produced fully 60 per cent. of the province's total of nearly 258,000 oz.; Boundary district mines, excluding Similkameen, came next with a little more than 17 per cent., including about 37,000 oz. from the Granby Co's mines, nearly 4000 oz. from the B.C. Copper Co's mines, and 2600 oz. from the Jewel mine. The Hedley Gold Mining Co's Nickel Plate mine, Similkameen, made its customary annual production of between 38,000 and 40,000 oz. Mines in Nelson division of West

Kootenay yielded between 8000 and 9000 oz. about one-half of which came from the Queen mine, Sheep creek, while the Motherlode, in the same camp, and the Relief, at Erie, added appreciably to the total of this division. From mines near the Pacific coast came fully 10,000 oz., of which nearly one-half was from the Granby Consolidated Co's Hidden Creek mine, near Observatory Inlet, and the remainder chiefly from the Marble Bay mine, Texada Island, the Rocher Deboule Co's copper-gold mine in the Skeena country, and the Engineer gold mine near Atlin.

Silver. Of an estimated total of 3,670,000 oz. of silver for the province, it is thought that between 2,200,000 and 2,300,000 oz. was produced from mines in the Ainsworth-Slocan district of West Kootenay, roughly rather more than 1,900,000 oz. from Slocan mines and than 300,000 oz. from Ainsworth mines. It seems probable that when the revised returns shall be in it will be found that the 1915 production of silver from these mines was larger than that of 1913 notwithstanding that the latter year was free from war and market troubles and too, had the benefit of a higher average price for the year than did 1915. Probably more than 40 per cent. of the Slocan total came from the Standard mine, near Silverton; the Hewitt-Lorna Doone in the same camp was next with an output of several hundred thousand ounces of this metal, and then the Surprise mine near Cody with between 200,000 and 250,000 oz. More than a dozen other mines in Slocan and half a dozen in Slocan City division together contributed to the total output of the district, from a few hundred ounces each from some small mines up to the considerable combined production of the Rambler-Cariboo, Lucky Thought, Slocan Star, Ruth Hope, and Mountain Con.

Of the Ainsworth mines, the Consolidated Co's No.1 is estimated to have produced in excess of 200,000 oz. while the Utica, Cork-Providence, Bluebell, and the Retallack Co's mine together added more than half that quantity, and half-a-dozen others each also yielded silver.

By far the greater part of the 600,000 oz. estimated as the production of East Kootenay mines was from the Consolidated Co's Sullivan mine, while the same company's St. Eugene mine yielded a few thousand ounces and the Monarch near Field, in the northern part of this district did likewise.

Boundary district mines produced a much decreased quantity of silver as compared with other recent years. Their total last year appears to have been less than 300,000 oz. and that notwithstanding that the Granby Co's mines, with a total of about 195,000 oz., did a little better than in 1914. The Union mine, in Franklin camp, probably produced 25,000 oz., but this is a surmise. Other Boundary producers were the E.P.U., Mother Lode, Jewel, and Skylark, all near Greenwood, and the Sally up the west fork of Kettle river.

Next in quantity from one district was Skeena, with about 167,000 oz. from the Granby Co's Hidden Creek mine, 22,000 oz. from the Rocher Deboule Co's mine, and approximately 50,000 oz. from several mines in the neighborhood of New Hazelton.

Rossland mines are estimated to have produced about 156,000 oz., of which nearly 25,000 oz. was from the Le Roi No. 2 company's Josie group and the large remainder from the Consolidated Co's Centre Star and Le Roi groups of mines.

The output of mines in the lower Coast district was about 72,000 oz., of which quantity the Britannia's proportion was 55,000 oz. and that of the Marble Bay mine, on

Texada island, more than one fourth of that amount. Other parts which yielded much smaller quantities of silver were Trout Lake and Nelson divisions, Camp Hedley, and Northeast Kootenay.

Lead—Mines in the province producing lead in considerable quantity are not nearly so numerous as those from which gold or silver, or both these metals are obtained. Of the total of nearly 42,000,000 lb. estimated as the output in 1915 quite 30,000,000 lb. is put down as having come from the Consolidated Co's Sullivan mine, in Fort Steele division of East Kootenay.

Slocan mines do not seem to have made anything like so good a showing as in other years, their total for 1915, estimated at about 7,000,000 lb., being, seemingly, less than one-half of that of either 1914 or 1912 and than one-third that of 1913. The surprise mine appears to have made the biggest production of lead in the district last year, estimated at between 1,600,000 and 1,700,000 lb., with the Rambler-Cariboo next as regards quantity; probably the Slocan Star and the Standard exceeded 1,000,000 lb. each, with the Hewitt-Lorna Doone mines of The Silverton Mines, Ltd. next with more than 500,000 lb. and the Ruth-Hope between 400,000 and 500,000 lb. Among at least a dozen smaller producers, the Wonderful produced most lead, next there was the Lucky Thought, and then the Wakefield and the Galena Farm, which last-mentioned mine only commenced production in November after having been closed for many years.

More than one-half of the estimated production of Ainsworth division is thought to have come from the Bluebell mine, but no returns were received, so this is a suggestion based on consideration of the average lead content of known earlier shipments of lead concentrate. About one-fourth of the Ainsworth total is regarded as having come from the Cork-Province mine; then come the Utica, No. 1, Early Bird, and Retallack & Co.

Nearly 1,000,000 lb. of lead came from the Emerald mine, near Salmo, Nelson mining division, and very much smaller quantities from three other mines in the same neighborhood.

Mines near New Hazelton in Skeena district, others near Ferguson in Trout Lake division, and the Monarch in Northst Kootenay were also producers of lead, though not in large quantity last year.

Copper. The most striking thing in connection with the year's production of copper was that of a total output of about 57,500,000 lb., nearly 35,000,000 lb. was from Coast districts which, prior to 1914 had always been the chief sources of copper production in the province. In 1914 the Coast district had a total of 24,000,000 lb. against that of the Interior of 21,000,000 lb., but in 1915 the increase of the Interior was only 2,000,000 lb., while that of the Coast was 11,000,000 lb. The consequence is that the Coast district is now far ahead of the Interior in the matter of present production of copper, and the prospects are that it will hereafter considerably increase its lead in this direction. The Granby Consolidated Co's Hidden Creek mine, near Observatory inlet, in 1915, made an output of little less than 662,000 tons of ore from which rather more than 21,800,000 lb. of copper was recovered. The Rocher Deboile Copper Co's mine shipped to Anyox 14,500 tons of ore that is estimated to have yielded a total of nearly 2,200,000 lb. of copper. The output of the Skeena country, therefore, was about 24,000,000. The Britannia mine, in Vancouver mining division, produced approximately 10,000,000 lb. and the Marble Bay mine, Texada island, may be credited with well on for 1,000,000 lb. These several amounts together make up the 35,000,000 lb. estimated as the copper production of the Coast district in 1915.

In Boundary district, the Granby Co.'s output from 1,035,000 tons of ore was about 16,046,000 lb. of copper;

the British Columbia Copper Co. produced 1,470,000 lb. The production of Rossland mines is estimated to have been 4,700,000 to 4,800,000 lb., that of Kamloops and Nelson between them nearly 200,000 lb. Rossland and Boundary each made an increase of not less than 1,000,000 lb. over their respective totals for 1914.

Zinc. While the total output of zinc is believed to have been not less than 11,940,000 lb., it is thought likely final returns will show this to be somewhat less than the actual production. Nearly all zinc figures are estimates, few returns having been received from shippers, though information from other sources warrants the conclusion that production was about as here stated. Zinc occurs in association with lead in the ores mined at the Bluebell, Cork-Province, and Utica mines, in Ainsworth division, but no account of these has been taken in making up the estimate, although it is known that some zinc ore was shipped from the Utica. Retallack & Co's mines at Whitewater are taken to have shipped ore that yielded 600,000 to 700,000 lb. Slocan mines from which zinc may be expected to be produced in larger quantity in 1916 than in 1915 are the Galena Farm (the concentrating mill at which was started late last year), Hewitt-Lorna Doone, Lucky Jim, Rambler-Cariboo, Ruth-Hope, Slocan Star, Standard, and Surprise with others in course of development that will probably add to the total production now that, through the enterprise of Mr. J. P. Keane, a custom concentrator is being operated in the neighborhood of Rosebery, Slocan lake. Approximate figures of production in 1915 from Slocan mines are—from the Standard mine 4,000,000 lb., the Surprise between 2,000,000 and 2,500,000 lb., and about 3,500,000 lb. as the total from the Galena Farm, Lucky Jim, Silverton Mines, Ltd. (Hewitt-Lorna Doone), Rambler-Cariboo, and Slocan Star. There is one fact that will tell in favor of 1916 to the disadvantage of 1915, namely, that there was last year much zinc product stored at Slocan mines awaiting sale that for this reason was not included in the production of the year, yet which is either now being shipped to the United States or will shortly be, and so will do to swell the total of production to be credited to 1916. One instance may be mentioned here; the zinc in concentrate stored at the Slocan Star mill has been variously estimated at from 10,000,000 lb. upward and late in the year this was sold, but, of course delivery will be in 1916, consequently this year will have the benefit of what was actually last year's production to the extent indicated.

Zinc carbonate ore was shipped from the H. B. mine, on Deer Creek, about ten miles from Salmo, in Nelson mining division, in quantity sufficient to make it appear that a production of between 1,000,000 and 1,500,000 lb. of zinc was made there. Then shipments of zinc ore from the Monarch mine, in Northeast Kootenay are reported to have been in large enough quantity to suggest an output of more than half a million pounds of zinc. From these two sources, then, there seems to have been a total output of approximately 2,000,000 lb. of zinc. So far as known, there was not any commercial production of zinc elsewhere in the province.

Other Metals. Some antimony ore was taken to Three Forks, Slocan, from the Alps-Alturus claims, situated high up on a mountain above a creek tributary to the north fork of Carpenter Creek. One carload was shipped to England, but there has been a long delay in receiving returns. A second carload has quite recently been reported to have been shipped to Chicago. Years ago a test shipment from the same property was made to Trail, but the value of the mineral at that time was too low to make mining the ore profitable.

Iron occurrences in the province do not appear to have been further developed in 1915, nor was there any commercial production of the ore reported. Molybdenum was

talked about and some newspaper statements concerning it made pleasant reading, but there was no production worth mentioning. A little platinum was recovered with gold on Tulameen river and tributary creeks; a statement made last October in the district to the writer was in effect that a branch bank at Princeton had during the season purchased more than \$1000 worth of platinum from Tulameen placer-miners.

Coal and Coke. An estimate made in December placed the gross production of coal at 2,060,804 long tons. In January corrected figures were received from one of the sources of information, with the cheerful intimation that "a mistake of 100,000 tons was made in the figures sent earlier." Accordingly the earlier estimate was that much out, gross production having been 1,960,804 tons, as now estimated. The exact production is not yet known, but it will be found to be about the quantity last above stated. Deducting 408,804 as the approximate quantity made into coke, a net production of 1,552,000 long tons may be regarded as close to what the official revised figures will be when arrived at later.

The net production of Vancouver Island mines is now estimated at 955,940 tons, as follows:—Western Fuel Co's mines, 411,470 tons; Canadian Collieries, Ltd's mines, 370,936 tons; Pacific Coast Coal Co's mines, 127,500 tons; Vancouver-Nanaimo Co's mine, 46,034. Nicola Valley mines produced 88,385 tons, of which 54,500 tons was from the Middlesboro colliery, 32,820 tons from the mine of the Inland Coal and Coke Co., and 1065 tons from that of the Pacific Coast Colliery Co. In Similkameen district, the Princeton Coal and Land Co. produced 12,675 tons. East Kootenay's net production is placed at 495,000 tons, of which 52,955 tons was from the Corbin Coal and Coke Co's mines and 442,045 tons from those of the Crow's Nest Pass Coal Co. In addition, the last-mentioned company made about 355,000 tons into coke.

Coke production is estimated at 248,424 long tons, of which 239,178 tons was made at the ovens of the Crow's Nest Pass Coal Co. at Fernie and Michel, and 9,246 tons at those of the Canadian Collieries (Dunsmuir) Ltd., at Union Bay, Vancouver Is and.

Structural Materials. The value of building and other structural materials constitutes by far the largest part of the amount shown as an estimate for "miscellaneous products." No details are yet available, but taking the proportions of the 1914 production of such materials as a guide, it may be assumed that of the \$2,000,000 estimated as the total value for 1915, fully 30 per cent, was that of portland cement manufactured in the province, 15 per cent. that of clay products, a similar percentage for sand and gravel, five per cent. for lime and limestone and the remaining 35 per cent. for building and other stone and rock.

Other Minerals. Mica occurs in the northern part of Revelstoke mining division, oil in the extreme south-eastern part of Kootenay district, and some others of those usually included in mineral production, but there was not any commercial production of these in British Columbia in 1915.

McINTYRE-PORCUPINE MINES

Under date of January 18, President A. M. Hay, gave out the following information to shareholders of McIntyre-Porcupine Mines Ltd:

Production and development operations for the quarter ended 31st Dec., 1915, were as follows:—Tons Milled 26,160; Value per ton \$7.39; Gross value \$193,261; Recovery \$184,233—95.42%; Operating cost \$108,748—\$4.16 per ton; Operating profit \$75,485.

At No. 4 Shaft on the south side of the lake there have been no recent developments of importance in the workings

which continue to give a steady production of milling ore. This shaft, which is now 600 ft. deep, will be sunk to a greater depth in the near future. During the period there have been several important developments in the workings at No. 5 shaft which has been sunk to a depth of 700 feet. Some extensive ore bodies have been located and are now being opened up on various levels. On the fourth level a vein 15ft. wide assaying \$8.00 per ton has been cut to the north of No. 5 vein and is either a new vein or an extension of No. 5, on which a large body of ore had already been opened up on this level. On the fifth level No. 5 vein in west drift is at present 25ft. wide, with an average value of over \$10.00 per ton. The continuation of this vein to the east of the cross-cut has been picked up where a fault was encountered displacing the ore about six feet. On the sixth level a cross-cut is being run to the north to intersect a vein recently cut by diamond drilling from the station on that level. No development work has yet been attempted on the seventh level owing to the present inadequate hoisting facilities, which will, however, shortly be improved. By diamond drilling from this level at an angle of 37 degrees, an orebody has been cut at a vertical depth of about 750 ft. from the surface, nineteen feet in width and showing by assays an average value of over \$18.00 per ton.

McIntyre Extension. This shaft is now down 985 ft., and will be continued to a depth of 1060 ft., in order to make provision for an ore pocket and sump. A cross-cut will be driven at the 1000 ft. level towards the McIntyre No. 5 shaft. This work will explore the ground between the two shafts and enable the workings of the two properties to be connected up for more economical operation. It should also intersect at that depth the ore bodies above referred to on the McIntyre property to the north of No. 5 shaft, which will be development work of very great importance.

McIntyre-Jupiter. The raise has been completed from the 300 to the 200 ft. level at No. 1 B shaft which will be used as a working shaft for the present. A new head frame embracing a crushing and sampling plant is being installed and the new compressor plant and mining equipment has been shipped and should shortly be on the ground. It is expected that active mining operations will be commenced by the time that the McIntyre new mill-unit is ready to receive and treat ore from this property.

Mill Construction. The extension to the mill building has been completed, but serious delays have been met with in the shipment of most of the material. Cyanide tanks are now in place, and most of the mechanism and piping has been installed. The tube mill is now in transit and shipment of the ball mill has been promised within a few days. It is expected that the new unit will be ready to operate about the middle of February, when the total capacity of the mill will be 450 tons per day. The increased milling capacity and the higher values to be expected from the ore bodies being developed on the lower levels should greatly increase the company's earnings during the present year.

In order to embrace a full period of twelve months from the date of the last Report and Balance Sheet issued to Shareholders, the Fiscal Year of the Company will be closed on the 31st March next, and the Annual General Meeting of Shareholders will be held in May.

DUPONT

Wilmington, Del.—Alfred I. du Pont, the deposed former vice-president of E. I. du Pont de Nemours & Co. and his associates have sent telegrams to the company's stockholders asking them not to send proxies for the annual meeting and election to President P. S. du Pont and other officers until a court decision has been made on the suit between the two factions that is now on trial.

INVESTIGATION OF BITUMINOUS SANDS IN NORTHERN ALBERTA

By S. V. Ells*

Since the advent of the fur traders during the eighteenth century, deposits of bituminous sand (heretofore referred to as "tar sand") have been recognized in Northern Alberta. These deposits are probably the largest of the kind in the world, yet, until recently, practically nothing has been known regarding their true economic importance.

In 1913 a brief reconnaissance of the deposits was made, during which upwards of two hundred and fifty individual outcrops were measured, and over 100 samples secured.

Following this preliminary examination, the writer suggested that a section of experimental pavement be laid. It was felt that such a pavement would illustrate in a practical manner the value that should attach to the Alberta deposits as a possible source of a suitable paving material. During 1914, a quantity of the bituminous sand was, therefore, mined and shipped to Edmonton. During the past season, this material was laid as a pavement in Edmonton. This pavement comprised sections

sheet asphalt mix, the resulting aggregate was further modified by the addition of clean and graded sand; in the case of the bitulithic mix, by the addition of clean sand and graded crushed gravel. In the case of the bituminous concrete, fine grained bituminous sand only was used, and was modified by the addition of graded crushed gravel and of clean sand. This manipulation also reduced the somewhat high percentage of asphalt cement present in the original material to the final percentage desired in each case.

In heating and mixing the materials, a heated rotary mixer was used. This mixer consists essentially of a revolving, jacketted drum, set on trunnions above a fire-box, and connected to the engine by shafting and gears. The inner surface of the mixer drum is fitted with baffles so arranged that a thorough mixing of charged materials is assured. Convenient charging and dumping facilities are provided.

In actual operation, and prior to charging, the drum was



Experimental pavement at Edmonton, laid under direction of S. V. Ells, of the Mines Branch, to demonstrate use of Alberta's bituminous sand deposits.

of three types of surfacing, viz., sheet asphalt, bitulithic and bituminous concrete.

As a site for this pavement, a section of Kinnaird Street, immediately south of Alberta Avenue, was selected. The traffic along this part of Kinnaird Street is such as will give a pavement a fairly severe test, and may be classed as heavy. Apart from a considerable volume of fast automobile travel, it includes vehicles which carry loads up to eight and ten tons.

Deposits of bituminous sand in Northern Alberta may be grouped in two classes, viz.:—(1) Deposits in which bitumen is combined with a coarse mineral aggregate; (2) Deposits in which bitumen is combined with a fine mineral aggregate.

The trial shipment used in the construction of the Edmonton pavement comprised both fine grained and coarse grained varieties, and, from a consideration of analyses of the crude material, three outstanding features were at once apparent:—(1) High penetration of asphalt cement; (2) Unbalanced mineral aggregates; (3) Excess of asphalt cement, (15%).

The effect of unduly high penetration was modified by partial distillation of the more volatile fractions. The unbalanced aggregates of coarse and fine bituminous sand were partially corrected by combining the two in a proportion of two of fine to one of coarse. In the case of the

usually preheated to a temperature of 250°-300° F. The bituminous sand was then wheeled in barrows to the loading platform, and the drum charged. During the first period of heating, the drum was kept closed by means of a damper. When, however, the bituminous sand had reached the desired temperature (400°-410° F) the heat was turned off, and the damper removed. The mix was then allowed to remain in the drum for a further period of 8 to 10 minutes, during which time the lighter hydrocarbons passed off freely as vapor.

Analyses of samples of the finished pavement indicate some room for improvement in the balancing of the mineral aggregate. In this respect, however, there should be no real difficulty in making desired modifications. The penetration of the asphalt cement is high. With a properly balanced aggregate this does not necessarily indicate a source of weakness.

The wearing surface mixture reached the street at an average temperature of 325° F., though the temperature of occasional loads was 350° F. It was immediately spread on the 6" concrete base with hot shovels and hot rakes.

Owing to the somewhat light nature of the contained asphalt cement, it was found necessary to exercise care in rolling. The best results were obtained by first rolling with a light (15 lbs. per linear inch width of tire) hand

*Mines Branch, Ottawa.

roller almost immediately after the wearing surface mixture had been spread. As soon as the temperature permitted—usually within three hours—a small quantity of Portland cement was sprinkled, and the surface thoroughly compacted by means of a 7-ton roller (250 lbs. per linear inch width of tire).

In the case of the bituminous concrete and bitulithic, the usual flush coat, with $\frac{1}{4}$ " stone screenings, was spread upon the surface, and all superficial voids filled.

The experimental pavement referred to above was opened to traffic on August 26th, 1915, and up to the present time, (December 20th), is in a satisfactory condition. It is obviously quite possible that defects may develop in this initial work with new and untried materials.

In considering past attempts, the writer considers that under favorable conditions, commercial extraction as applied to the McMurray deposits will be found practicable. Further, it should be remembered that, owing to freight and other charges on imported asphalts, extraction in Alberta would be on a much more favorable basis than has, for example, been the case in California where competing residuum can be sold at a very low figure.

It is of importance to note that, in December, 1915, grading along the Alberta and Great Waterways Railway was practically completed as far as the proposed terminus at McMurray townsite. In descending into the Clearwater valley near McMurray, railway cuttings have been made at three points in the bituminous sand itself. With-



Example of topographic maps recently completed by S. C. Ells, illustrating typical mode of occurrence of bituminous sand deposits in Northern Alberta. All streams tributary to the Athabaska river in the McMurray district have been mapped in this manner. The maps were originally drawn on a scale of 1 inch equals 400 feet, but have been reduced to the present scale of 1 inch equals 1000 feet.

Outcrops of bituminous sand are almost altogether confined to slopes of older valleys, and to cut banks along present water courses. Elsewhere the surface of the country is level, and represents a plain.

On the maps, outcrops of bituminous sand are indicated to scale, at certain points. It should however, be remembered that these outcrops represent a single deposit which is practically continuous throughout the whole area.

Nevertheless, there are strong indications that, with minor modifications in manipulation, Alberta bituminous sand can be successfully adopted as a basis for satisfactory asphaltic pavements.

From a comparative study of cost data based on the use of Alberta bituminous sand and of imported asphalts, it appears that the application of the former in the crude state will be restricted within comparatively narrow limits in Western Canada. Indeed, extensive development of the McMurray deposits will probably depend on the commercial application of an extraction process whereby the bitumen can be marketed in a more or less pure form. Such a process would doubtless ensure for the McMurray product a wide market, not only as a paving material, but in many other recognized applications for high grade bitumen.

At various places in the United States during the past twenty-five years, the commercial extraction of bitumen from bituminous sands and sandstones has been attempted. Owing to various recognized causes, none of these attempts have met with commercial success. Nevertheless, in view of the various factors that must be taken into account

in a radius of one mile of the terminus of the road, a number of other outcrops are readily accessible. It is expected that track laying and ballasting will be completed during the winter and summer of 1916. The distance from Edmonton to McMurray over the new railroad will be approximately 335 miles.

In a pamphlet recently prepared by the writer, reference was made to the occurrence in the McMurray district of certain of the higher grade clays. In addition to deposits there noted, samples secured during the past season indicate the presence of stoneware clay, suitable for the manufacture of pottery, such as jugs and crocks, or for sewer pipe.

During the past season, topographical mapping of the area underlain by bituminous sand was also carried on. On this map are shown extent and position of individual outcrops, as well as thickness and extent of overburden. The map also indicates those areas which may most advantageously be developed, and will serve as a basis for an approximate estimate of the total tonnage of bituminous sand available.

SURF INLET GOLD MINE

"The Province", Vancouver, printed the following in its issue of Jan 1:

With the payment of \$150,000 to the Surf Inlet Company of this city by the Tonopah-Belmont Company of Philadelphia, ownership in one of the great gold mines of the province passed from Vancouver hands to mining men from across the line. Mr. Fred M. Wells, the mining engineer who first realized the potential possibilities of the Surf Inlet as a gold producer, and who put in four years of his life developing the property before it was taken over by the Philadelphia company, is in the city to-day. He states that while he will participate in the first payment along with the other large stockholders in The Surf Inlet Company, he likes the clause which allows the original company a one fifth interest in the property, irrespective of the sale.

The option which the Tonopah-Belmont Company held expired to-day but the cash payment of \$150,000 was paid to-day, guaranteeing to the public the real success of the enterprise.

The camp was first developed by Victoria men and although they sold out at an early date and probably without reaping the fullest reward for such pioneer work, still it will give them satisfaction to know that through their efforts a gold camp of great promise has resulted.

Closely following the Victoria men's operations, Mr. E. A. Cleveland of this city became interested and made a serious and well-directed effort to develop what is now the Surf Inlet mine, but through the failure of adjacent properties the camp was given such a black eye that it became impossible to secure necessary capital and operations on his property were also closed. While it has been a long wait for Mr. Cleveland, the results of his early mining venture have been very profitable, for aside from the good cash figure which he has already received, he is one of the heaviest holders of shares in the present Surf Inlet Company.

During the early development of the camp the ore was mined and packed to salt water on horses and shipped to the smelter for treatment. Although the ore contained good gold values the cost of handling was so great that it resulted in a loss and discouragement and finally closing down the works.

After lying idle for several years the camp was brought to the attention of Fred M. Wells and A. B. Clabon and resulted in Mr. Wells making a trip to the camp and thoroughly examining several of the properties. Mr. Wells was very favorably impressed with the possibilities of the mines and in the interest of himself and Mr. Clabon secured an option on the group, known as the "D. L. S." group and owned by Mr. E. A. Cleveland of the firm of Cleveland & Cameron of this city. With the object of developing the property a company was formed, composed of local Vancouver business men and known as the "Surf Inlet Gold Mines Limited."

The development of the mine was placed in the hands of Mr. Wells and during the following four years about \$100,000. was expended. The result of this work was to prove the ore to a depth of about 500 feet and a continuous length of several hundred feet along the vein, demonstrating its value and size to that depth.

Realizing the necessity of still further development and the building of a milling plant, involving large capital, the local company decided to be relieved of this responsibility and gave an option to the Tonopah Belmont Development Company of Philadelphia. This company is made up of a group of wealthy Philadelphia men with Mr. Clyde A. Heller as president. They own and operate some very large mines, including the noted Tonopah-Belmont mines

of Tonopah, Nev., and have been most conspicuous by their successful operations.

Work on the option began about May 1, 1914. The equipment at the mine necessary for the work consists of a power plant of two 50-horsepower boilers, a ten-drill compressor, an electric plant for lighting, blower for ventilation, small hoist, etc.

As the mine is 6 miles from salt water, roads had to be constructed, gasoline boats put on the lakes, besides the fine ocean-going power cruiser "Full Moon," purchased from Mr. Knox Walkem of this city, to assure communication at all times with the outside.

All operations at the mine were placed in the hands of Mr. F. W. Heller, mining engineer. A working force of about 50 men have been engaged up to date. A very complete set of buildings were erected, consisting of comfortable bunkhouses, cook and dining houses, powerhouse, blacksmith's shops, office building, assay office and cottages for men, forming in all quite a neat group of buildings, which, when brightly illuminated with electric lights, reminds one of some of the old-time gold mining days of other camps.

Up to the present the company has done about 6000 feet of development. While some work was done in the upper workings the greater part consisted of opening up a new level by a tunnel nearly 3000 feet in length, which cuts the ore body about 500 feet below the old workings, and nearly 1000 feet from the surface. The orebody was encountered on the low level in July, and since that time several hundred feet of ore has been developed, which, from its great size and high values will soon make the mine famous by its production of gold bullion.

Development work will continue on the mine, and a large mill will be built at once, together with development of a hydro-electric power plant for operation of mine and mill.

"While the Tonopah people are to be congratulated on the success of their first business undertaking in British Columbia," said Mr. Wells this morning, "we are glad to say the Vancouver owners who first developed the property hold an enviable place in the future of the mine, for besides the cash received, the Surf Inlet Company retain a fifth share in the future profits of the mine."

"The successful development of the Surf Inlet mine, solely by local business men, is a real object lesson for the people of this city to think about. Situated as we are in the centre of a great undeveloped mining country, there is no reason why a fair portion of the money available for new enterprises should not be devoted to the development of our own mines. Especially does this idea apply to the initial development of prospects. Like all other classes of business it is essential that experience and good judgment guide the operations."

The directors of the Surf Inlet Gold Mines Limited are Col. J. Duff-Stuart, president; E. A. Cleveland, vice-president; A. H. Wallbridge, treasurer; A. H. MacNeill, K.C., Jonathan Rogers, W. B. Burnett, M.D. and B. G. Hawkins, secretary.

MAXIM MUNITIONS.

New Haven, Jan. 21—Maxims Munitions Co. plant here will resume operations on Friday of this week. Installation of machinery from one of the company's plants in Derby occasioned the temporary cessation of work in the main plant here.

The corporation expects to receive a part of the big contract from the Russian Buying Commission for machine guns.

Engineers are making plans for the erection of a new building close by the main plant where company expects to turn out ammunition.

CORE DRILLING AT THE HOLLINGER

By Albert M. Brown

The rapid growth of the Northern Ontario gold mines has formed one of the sensational features of mining history in the past few years. One of the most interesting and successful of these properties is the Hollinger Gold Mines, Ltd., of Timmins, Ont., Canada. Starting operations in 1911 by milling 1,000 tons of ore, valued at \$46,082.00, it has jumped ahead, until, during the year

depth of 500 feet. Owing to its light weight and the fact that it may be dismantled if desired, it is easily pulled up into the high, narrow stopes and there set up.

The "S" drills are of small size and compact, especially adapted to work in drifts where space is limited. The drill rods and core barrels on all these machines are five feet long, permitting operation in cramped space without



Core Drilling at the Hollinger Mine

1914, 208,936 tons of ore was milled, carrying a valuation of \$2,688,354.00. Up to July 1, 1915, the total dividends paid by the company have amounted to \$3,600,000.00.

The use of core drills has been of great assistance to the management in carrying on the rapid development of the property; and several ore bodies which had been missed by the ordinary methods of cross-cutting have been subsequently located by diamond drilling.

The company carries on diamond drilling underground as a regular part of the routine work. Vein walls are prospected for branch veins by means of series of short horizontal holes, and extensions to veins which appear to have pinched out are sought for by similar means. Up to October 7, 1915, 21,344 feet of core drilling has been performed at the property.

For assistance in determining the best method of development, four Sullivan diamond drills are employed. Two of these are class "S," having a capacity of 700 feet in

the necessity of cutting a station to operate the drill. The underground machines are run by compressed air.

The Hollinger Company, in addition to its underground drilling, has undertaken to determine the extent of its



Sullivan "E" Core Drill in a Drift at Hollinger Mine

depth and removing a 15/16 inch core. A third is a class "E" machine, mounted on jack screws and employed in the narrow stopes for testing the various pockets of ore, which often occur on the main vein. The "E" drill takes out a core 15/16 of an inch in diameter and will drill to a



Sullivan "B" Core Drill at Hollinger Mine

veins at depth, and for this purpose during the past year employed a Sullivan class "B" diamond core drill having a rated capacity of 3,200 feet. This drill removes a core 1½ inches in diameter and uses 10 foot drill rods. It is operated by compressed air.

The hole was started across the property at an angle of 60 degrees from horizontal. It was bored to a depth, measured along the drill hole, of 2,000 feet, the vertical depth at this point being 1,425 feet. The angle of the hole flattened as its depth increased, so that at its final depth it was advancing at an angle of 45 degrees with the surface. The total variation in the 2,000 feet was therefore 15 degrees. The tendency of angle holes to rise is well known and was allowed for by the management.

The 2,000-foot hole was put down in a little less than three months. The average run, working two twelve-hour shifts per day, was 40 feet in 24 hours. The longest run in a single day was 55 feet. A tripod 50 feet in height was erected over the drill hole and the rods were hoisted in 30-foot sections, so as to save time in hoisting and lowering. Due to the use of this high tripod, it was also possible to substitute a 20-foot double tube core barrel for the ordinary 10-foot barrel. By the use of this special core barrel, which consists of two barrels in reality, one being an inner casing on ball bearings to protect the core from the wash-water and the jar of drilling, from 85 to 90 per cent of the core was recovered from the hole.

The "B" diamond drill is equipped with a Sullivan single cylinder hydraulic feed, an important feature in deep drilling such as this, as it is very sensitive, permitting the operator to adjust the feed accurately to the formation of the ground, which in this vicinity is very broken and variable. The country rock, through which the drill passed in the work, was a soft schist, whereas the vein material was the gold bearing quartz, very hard in comparison. The hoisting gears are proportioned for a heavy line of rods, the drum making one revolution to 39 of the engine. For shallower holes and lighter loads, direct gearing in the ratio of one to 13 permits a more rapid hoisting speed. One revolution of the drum winds up about six feet of the rope.

PORCUPINE AND COBALT DIVIDENDS IN 1916.

Under date of January 26, the "Toronto World" which has lately been devoting considerable space to mining news, prints the following comments written by Mr. Dick Pearce:

How long it will take the gold mines of northern Ontario to pass the annual dividend record of the silver mines is a question that is causing considerable interest in mining circles.

Cobalt mines paid up to the end of last year over sixty millions in dividends—to be exact, \$62,100,827. This record dates from the first year of operation, as it does not take long to get a property in shape for shipping the white metal. Dividends last year of silver companies totaled \$4,289,039 and gold companies \$2,277,187.

Twenty-five incorporated companies have paid dividends out of Cobalt, while private corporations accounted for \$3,825,000 out of the total. Last year twelve companies paid dividends, and bonuses of private corporations amounted to \$175,000. The Nipissing mine has paid \$13,840,000 in dividends or about as much as the next two companies on the list.

Ten companies have paid back their capitalization. The Hudson Bay has paid its capitalization back 250 times. The Beaver has paid 295 per cent.; Buffalo, 282 per cent.; Nipissing, 224 per cent.; Crown Reserve, 196 per cent.; Seneca-Superior, 205 per cent.; McKinley-Darragh, 205 per cent.; Kerr Lake, 199 per cent.; Coniagas, 196 per cent., and Trethewey, 108 per cent.

The highest dividend payer last year was the Seneca-

Superior with 70 per cent. Nipissing was next with 20 per cent., followed by Coniagas with 15 per cent.

So far only one Porcupine company, the Hollinger, is paying back its capital. The total disbursement to the end of 1915 was 139 per cent., involving \$4,170,000. The Hollinger is now on a dividend basis of 52 per cent. per annum, or \$1,560,000. The Hollinger was the largest dividend payer last year among the gold and silver mines, Nipissing following with a disbursement of \$1,200,000.

The Dome started on a 20 per cent. basis last year and paid a half yearly dividend of 15 per cent. amounting to \$400,000. This year's disbursement will be \$800,000 and it is possible that a bonus bringing disbursements well over the million mark may be made. The Dome last year milled 317,873 tons of ore, recovering \$1,307,322 in gold. This year the production will be greatly increased.

The Porcupine Crown paid 12 per cent. last year and it is unlikely that any change will be made. The mine runs along smoothly, steadily producing gold.

The Tough-Oakes mine was put on a 10 per cent. basis last year. Only one-quarter yearly dividend was paid in 1915. The second was paid this month. The Tough-Oakes is the first gold mine in northern Ontario outside of the Porcupine district to pay dividends. On a 10 per cent. basis the 1916 disbursements will be over \$260,000.

Col. Hay stated to The World representative that if developments at the mine continue, McIntyre will be on a dividend paying basis this year. McIntyre's attention has been given to making the property into a big mine rather than paying dividends. In the long run this will be a good thing for the company, as it places it in a position to mine advantageously.

Without counting in the possibility of a dividend from McIntyre the gold mines of northern Ontario will pay close to three million dollars in dividends during 1916. Added to this the probabilities of increased dividends by the gold mines are well worth taking into consideration.

On the other hand, Cobalt is a problem. It is doubtful if 15 companies will pay dividends this year, but some will increase.

On the whole it would almost be safe to say that Cobalt dividends would decrease in 1916 while the gold mines will make increased disbursements.

L. S. IRON ORE TRADE.

Iron Ore says; The Steel Corporation has made contracts with vessel interests for the carrying of iron ore from its Lake Superior mines for a period of five years a certain tonnage to be carried annually. As these contracts are made outside of its own big fleet they show that the big steel maker expects to have a big tonnage to handle in the years to come. It's a pretty favorable indication that business is expected in considerable quantity above the carrying capacity of the corporation's fleet of ships.

Vessel interests look forward to a fine business in the coming season of navigation on the Great Lakes. Contracts already made insure this, the advanced price for carrying ore over 1915 rates being 10 cents from the head of Lake Superior.

GERMAN INFLUENCE IN METAL MARKETS.

New York copper men believe that report from London that British government would shortly seek information about stock-holders and business connections of certain firms in the United States foreshadows an effort by England to wrest from Germany her powerful influence on metal markets of the world. Strength is given this belief by decision rendered a few days ago in Court of Appeals, London, in case dealing with the Australian zinc situation. Under this ruling precedent was given English holders of contracts to deliver ore to German refineries to break their agreement permanently.

THE BURNS CLAIMS SHAW TP.

Under date of Jan. 22, "The Porcupine Herald" prints the following extracts from two reports on the Burns' claims in Shaw township:

"These claims are situated in the south eastern part of the Township of Shaw, in the Porcupine Mining Division, District of Nipissing, Ontario. There are three claims, numbered 13890, 13891, and 900P. "The first two have been surveyed and contain about 40 acres each. 900P has not yet been surveyed but contains approximately thirty acres.

The claims in the winter are reached by sleigh road from Porcupine to what is known as the Hudson Bay Camp, a distance of 5 miles. From here there is a well beaten trail to Kings Landing on the Redstone River, a distance of four and a half miles.

"From here the trail runs up to Redstone for three miles, and then one and a half miles overland to the property. The end of sleigh road from Porcupine is four miles in a direct line from the property. Little development work has been done beyond stripping.

"The principal vein is of quartz impregnated with iron pyrite and showing occasional free gold. It has a strike slightly west of north, and has been traced pretty well through the two claims, 13890 and 13891. It runs through the centre of these claims. The average width is probably twelve feet and it has been stripped across in several places.

"A sample taken across 11 feet 4 inches gave an average of \$13.85 in gold per ton. This sample was taken in sections and the values appear to be evenly distributed throughout the vein.

"Another vein is of quartz and is a foot in width. It runs parallel to the main vein and has been stripped for a couple of hundred feet and traced for that much more. Free gold shows here and there all along where it has been stripped. At one point a pit four or five feet deep has been sunk on it, and free gold shows in the bottom. This is the only point on this vein where any shots have been put in.

"Several other quartz veins, some carrying free gold are said to have been found on these claims, but owing to the deep snow we were unable to see them.

"The main shaft is a wide one and carries good values. The ore from a vein this size can be extracted cheaply, and the greater part of the gold is free. The vein is persistent in length, and if the values continue with depth, as they so far have done in this district, the property will undoubtedly make a mine."

Since the report was written development work has been done and a two stamp mill put in operation.

MILLER-INDEPENDENCE.

Timmins, Jan. 22—The last payment for the McDonough claims at Boston Creek has been made, and Mr. G. J. Miller has the deeds. Mr. Miller was in town on Saturday on his way to the Miracle Mine from Dayton, Ohio, and showed some beautiful samples of telluride and gold ore from the Miller-Independence mine.

The mill has been built under the supervision of Mr. Adams, late of the Dome staff, and another boiler went into the property last week.

The Dodge crusher is in place and milling operations will start shortly. The gold will be saved by amalgamation over 12 foot tables, and the concentrates will be shipped to the States.

About twenty men are now working at the mine and all the camps are built. Up to date six veins have been uncovered, but most of the work and the sinking is being done on the original veins which carry very high value.

The Miracle mine, of which Mr. Miller is also president, will start milling operations the latter part of February.

A small gang of men have been working under Captain Ransome and some very good ore has been encountered at the 70 foot level.—Porcupine Herald.

GRANBY CONSOLIDATED

Boston—Granby Consolidated proposes to reduce par value of its shares from \$100 to \$25 and to issue four shares for one. It is believed the new shares will become more popular as trading units.

Granby originally had 1,350,000 shares of \$10 par which several years ago were changed to 135,000 shares of \$100 par.

Boston was the original trading centre for Granby shares and practically all transactions have taken place in this city, notwithstanding the fact that the company maintains its office in New York, its shares are listed there and its actual management is conducted from that city.

The year 1915 was a good one for Granby but as its fiscal year does not end until June 30, figures for a twelve-month will not be available until the coming fall.

As with all new plants, there were delays and disappointments encountered at the new property at Hidden Creek but recent results have been very satisfactory.

In December the new Anyox smelter treated 72,000 tons of ore, which was larger than expected, as the cold weather makes continuous operation very difficult in the winter months. The cost of producing copper at this plant is now 8½ cents a pound, but with normal operations after the winter, an 8-cent cost is looked for.

Dividend requirements at the current rate of \$6 per annum can be more than supplied from operations at the old Grand Forks plant where costs have been showing an advancing tendency. No better than 11 cents a pound can be hoped for at that property but so long as copper holds at or near its present high level this department of the company's operations can be made to give an excellent account of itself.

Granby is expected to increase its dividend before the end of its current fiscal year—probably during the second rather than in the first quarter of 1916.

A special meeting will soon be called to vote on reduction of par value.

GEOLOGICAL MAPS

We have received from the Geological Survey, Department of Mines, Ottawa, the following recently published maps, copies of which may be obtained on application to the Department.

- Map 147A, Cranbrook, Kootenay District, B.C.
- Map 142A, Field, Kootenay District, B.C.
- Map 116A, Southwestern Ontario.
- Map 111A, Vananda, Texada Island, B.C.
- Map 110 A, Prescott, Paxton and Lake mines, Texada Island, B.C.
- Map 41A, Duncan Sheet, Vancouver Island, B. C.
- Diagram of city of Montreal and vicinity, showing location of artesian wells.

CROWN CHARTERED.

The "Porcupine Herald" hears on good authority that a syndicate has optioned the Crown Chartered mine, and that the Porphyry Hill property is optioned to the Northrup Syndicate until February 1st.

McAULAY-BRIDGE CLAIMS OPTIONED.

Timmins, Jan. 22—The McAulay-Bridge claims in Bristol have been optioned to Col. Hay, president of the McIntyre Porcupine Mines.

GERMANY AND THE METAL TRADES.

Opinion differs as to how far Germany will be able to stem and surmount the prejudices of the world when the war is over. Will she be shorn of many of her commercial and economic advantages or will she be able to recoup some of her present losses by trade aggression? Her grip upon the dye industry, her prominence in the realm of shipping and her dominance of the metal trades are among the strongest of her bulwarks threatened.

Complete readjustment of relations existing between German metal houses on one hand and mining and smelting corporations, largely British owned and controlled, on the other, looms forth as one of the results of the European war. The heretofore powerful influence of the Frankfort and Hamburg concerns may thereby be eliminated. Tangible steps along this line have already been taken by the British government and courts and the effect will ultimately be felt in the United States where these German houses have affiliations and through which copper in former years and zinc concentrates at the present time come to the United States.

Through its "trading with the enemy" bill Great Britain has been working out a plan whereby some of the largest London metal firms, which before the war were closely allied with German firms, could be placed under government supervision. The Court of Appeals in London has just rendered an important decision making possible the abrogation of contracts between English owned mines and German metal houses even after the end of the war.

Another step in this direction comes in the request of the British government for metal concerns in London to file specific data as to ownership, identity of clients and other pertinent business secrets. A year or more ago there was an investigation of some of the metal houses, notably Henry R. Merton & Co., one of the largest in the world. A list of stockholders indicated that a very large part of its shares, if not control itself, was held in Germany. The company had 25,000 outstanding preferred shares and ordinary 70,000 shares. The largest blocks were held by Germans, as shown below:

	Ordinary
Metalbank-Metallurgischegesellschaft.....	18,600
Metalgesellschaft.....	11,875
Schweizerischegesellschaft für Metalwerke.....	11,875
Merton Metallurgical Co.....	1,240

An appeal taken by Aron Hirsch & Sohn of Halberstadt, Germany from a lower court decision which nullified its contract with the Zinc Corporation resulted in an affirmation by the Court of Appeals in London of the lower court decision. Thus the Hirsch firm has lost the contract, which would not otherwise have expired until 1919, for concentrates produced by the Zinc Corporation, one of the largest Australian zinc properties. This contract called for a minimum of 85,000 tons and a maximum of 95,000 tons per annum.

The United Metals Selling Co., Phelps, Dodge & Co., and the American Smelting & Refining Co. have long maintained branches or agents abroad including offices in London. Control of these companies has always been held in the United States, there being absolutely none other than American ownership and management.—Boston News Bureau.

DOMES EXTENSION

Timmins, Jan. 22—Capt. Anchor has returned to Porcupine and is now superintending the work preliminary to the re-opening of Dome Extension, and it is to be expected that new developments will be reported from the property itself within the course of the next fortnight.

Some of the most recent developments on the Big Dome point strongly to the probability that the big ore bodies of the Dome will be encountered on the Dome Extension.

CANADIAN SHELL MAKING

Gen. A. Bertram, president of the former shell committee of Canada, says in the Monetary Times: "The first order for shells from the English authorities was for 100,000 18-pounder empty shrapnel shells. It was a new venture for any Canadian manufacturing establishment and while the price of \$8.55 per shell may appear high in light of to-day's experience, yet at about the same time an order for 1,000,000 18-pounder shrapnel shells was placed in the United States at \$10 per shell. To the credit of Canadian manufacturers, they have completed 3,000,000 shells at average cost of \$6.50 and the United States concerns have not yet completed their order and are asking extension of time.

"Total number of shells placed has been approximately 22,000,000; materials and quantities used: Steel, 800,000-000 pounds; brass, including copper and zinc, 44,865,617 pounds; copper, 21,595,832 pounds; lead, 101,758,327 pounds; tin, 1,447,708 pounds; resin, 10,037,506 pounds; powder, 4,094,531 pounds; cordite, 9,649,990 pounds; nitrocellulose powder, 3,750,000 pounds; trinitrotoluene, 10,690,000 pounds.

"Monthly output of shells, 1,100,000; labor employed, approximately 80,000 to 90,000 men, including skilled and unskilled labor. There are also 1500 inspectors.

"As the business developed in Canada, as experience was gained, we were enabled to greatly reduce cost production, so much so that on our present contracts we expect to save the imperial exchequer probably \$30,000,000 as between price of the original orders and prices now being paid manufacturers.

"One measure of satisfaction we shall always have—namely, one of the largest industries in America to-day, which will mean a productive output to the end of August of over \$350,000,000.

THE MURDER OF AMERICAN MINING MEN.

At the meeting of the Board of Directors of the American Institute of Mining Engineers, Jan. 21, 1916, the following resolution was passed:

RESOLVED That this Board has learned with indignation and sorrow of the unprovoked and brutal murder of eighteen American citizens on January 10th, in the State of Chihuahua, Mexico, and laments especially the death of Messrs. C. R. Watson, C. A. Pringle, H. C. Hase and W. J. Wallace, who were members of the American Institute of Mining Engineers. As these men and their companions were engaged in the lawful prosecution of their work, we trust that nothing will be allowed to prevent or delay appropriate action by our Government concerning the outrage by which they lost their lives.

RESOLVED that the sincere sympathy of this Board and of all the members of the Institute is extended to the families and friends of Messrs. C. R. Watson, C. A. Pringle H. C. Hase and W. J. Wallace.

AND BE IT FURTHER RESOLVED that a copy of this resolution be sent to the Secretary of State of the United States, be published in the Institute Bulletin, in the press, and be sent to the families of the deceased members.

CANADIAN MINING INSTITUTE.

A meeting of the Toronto branch of the Canadian Mining Institute was held at the Engineers club, Saturday, Jan. 15. There was a lively discussion of the nickel question, many members taking part. The speakers expressed hopes that nickel refining in Canada will soon become a fact.

PERSONAL AND GENERAL

Mr. T. B. Williams, Engineer for The Canmore Coal Co. of Canmore, Alberta, has returned to the west after spending a month among his friends in Ontario.

Mr. A. A. Hassan has opened an office at 203-204 Riggs Building, Washington, D. C., for geological and mining engineering work. He has been prospecting with diamond drills gold deposits in Montgomery Co., Maryland.

Mr. J. B. Tyrrell has returned to Toronto from Porcupine and will sail on Feb. 9 for England.

Mr. Robert Bryce is at Sheridan, Montana, and expects to be there for a few months.

Mr. B. Neilly was in Toronto last week.

Mr. C. A. Foster of Haileybury has been in Toronto in connection with litigation over property at Kirkland lake and the arrangement of other matters which should result in increased activity in the mining districts along the T. & N. O. railway.

Mr. T. H. Rea is in Toronto. He is making headquarters in Chicago.

Mr. David Sloan formerly manager at the Rea mine was in Toronto last week.

Mr. G. C. Bateman is in Toronto.

Mr. T. W. Gibson and Dr. W. G. Miller, members of the Ontario Nickel Commission, have returned to Toronto after a visit to Cuba in connection with the nickel investigation.

Col. A. M. Hay, president of McIntyre-Porcupine mines, is at the property.

BOOK REVIEWS

Monetary Times Annual Statistical Review and outlook number. Edited by Fred W. Field, Published by Monetary Times Printing Co., Toronto. Price 50 cents.

This volume tells the story of an exceptionally interesting year in Canadian affairs. The great effects of the war on all industries and the ways in which Canadians have met the many new problems are set forth in an excellent series of articles by well known men. The larger part of the book is devoted to banking, bonds and investments, and insurance. Forty pages contain information classified under the heading "industrial." In these pages appears information concerning the mining industry. The Nova Scotia Steel and Coal Company is dealt with in a special article, and Mr. T. W. Gibson contributes some notes on nickel.

Heaton's Annual 1916—Commercial handbook of Canada and Boards of Trade Revenue. Published by Heaton's Agency, 32 Church St., Toronto.

This is the twelfth annual edition of a useful handbook. It enables one to find information which is not readily available, and buried in many diverse publications. The section headings are: official directory, correspondence, financial, commercial regulations, registration offices, credit reports, transportation, banking towns, customs, where to find it, towns and local opportunities, general information, agricultural districts and crown lands regulations, and tables.

A notable part of the book is the section "where to find it." This should prove a handy reference, enabling one easily to obtain information on diverse subjects.

INTERNATIONAL NICKEL.

New York, Jan. 25—In three months ended Dec. 31 last International Nickel Co. had a balance equivalent to about 7% on the common stock.

In the first nine months of the current fiscal year, after allowing all charges for depreciation, mineral exhaustion and preferred dividends, the company earned about 20% on the increased amount of common stock. Thus the full year's cash dividends were earned in nine months.

Gross earnings in the quarter ended with December were greater than any previous quarter in the company's history. It is expected the last half of the fiscal year will show gross earnings fully 50% in excess of gross for the first six months, with commensurate gain in balance for dividends.

Cash balance at close of fiscal year March 31, if no extra dividend is charged out in the meantime, will approximate 25% on the common stock. There is reason to believe that common shareholders will receive substantial extra cash dividend in the near future.

BOSTON CREEK.

Cobalt, Jan. 22—A new vein has been found on the property of the Miller Independence mine at Boston Creek. It strikes directly across the first discovery made. At one point where it has been uncovered there is a width of several feet of quartz, and in this quartz there is a good deal of free gold and sulphides. It is, moreover, not as flat an ore body as the first discovery.

A shaft is being sunk on the original discovery. Owing to the character of the ore body there has been some difficulty in following it. It has been in and out of the shaft once or twice already in the short distance to which the shaft has been sunk now.

A boiler has recently been taken in over the trail from Boston Creek, and, as a compressor and other equipment, including a small Nissen stamp mill purchased from the Dome, preceded it, the Miller Independence should soon be working under steam. The thick crust which formed on the snow last week made the breaking of roads quite difficult for some time, but the passage of the boiler over the trail from Boston Creek should make it quite good for the rest of the winter.

Some ore has already been bagged from the original discovery, and taken to an ore house which has been erected.—The Northern Miner.

ACCIDENT AT DOME MINE.

Timmins, Jan. 22—At five minutes to twelve 3 workmen lost their lives last night by a fall of muck on which they were standing in No. 3 shaft, precipitating them with the rock a distance of some 140 ft. to the 600 ft., level. The name of the deceased are: Mike Cahill, J. H. Smeltzer and Bernardin Deshais. Mike Cahill is well known in the camp since the early days and is an expert miner.

J. H. Smeltzer, whose wife lives in South Porcupine comes from Guelph, Ontario, and B. Deshais comes from Three Rivers and has a brother working at the Tough-Oakes mine. From enquiries it seems that the chute was hung up in the raise and a pipe driven into the pile was to be filled with powder to loosen it up. The end of the pipe had been battered up with hammerings and had just been sawn off when without any warning the mass fell to the bottom carrying the above deceased with it. H. Charette, W. Asseltine, and H. Lajeunesse, were also on the edge not two feet away and had a narrow escape. Ah inquest will be held—Porcupine Herald.

SPECIAL CORRESPONDENCE

NEWFOUNDLAND

Copper. The first copper ore for the new smelter, has just been landed at the dock yards of the Reid Newfoundland Co. from the S. S. Newfoundland which ship arrived from Little Bay Mines early in the week. It is the first cargo of ore that has been shipped from these mines since 1900, when work was abandoned. This cargo of ore was taken from the dumps of which there are upward of ones hundred thousand tons lying on the surface and which can be handled very cheaply. Several tons of this ore in large pieces weighing from three to five hundred pounds is on exhibition at the dock yards and in some of the store windows along the street. One particularly large block of ore is exhibited in the window of Bishop & Sons. It weighs from three hundred to five hundred lb., and Mr. McKay, President of the smelting company informs us this piece alone is worth \$75, and he says there are tens of thousands of tons of high grade copper ore in the dumps at the mines equally as good as the samples on exhibition.

The smelter is now about completed, and the work of smelting the ore will commence at once. The enterprise is being watched very closely by the mercantile and mining classes of the country, and on the success of this undertaking, which will be a good test of the smelting of ore by electrical process, will depend the introduction of a system of small smelters, which is so very much needed in Newfoundland to make mining a success. It is a system similar to this which has prevailed in the Western States, and has made mining the success it is in that country.

With the success which we have every reason to hope Mr. McKay's smelter will attain, there is every reason to expect that the Government of Newfoundland could be induced to erect a few small smelters in the mining districts and thus encourage an industry which has given so much wealth to the world. With a system of small smelters established throughout the country every man who owns a mining claim can go to work and develop same. It needs comparatively little capital to do this, and every pound of copper which he takes from his property, can be converted into cash at the smelters. In this way some hundreds of very valuable copper properties which are simply being retained from year to year by individual owners, by the paying of the necessary mineral fee to the Department of Agriculture & Mines, would be developed into very profitable industries, to the advancement of the country and the betterment of its people.

Coal Famine. A very serious problem faces Newfoundland this winter in the matter of a supply of coal for its people. The question has become most serious, so much so that the Government was obliged at the beginning of the year to commandeer every ton of coal within the city of St. John's. The shortage of supply is owing to no available shipping for this trade.

Newfoundland gets all her coal from Sydney, C. B., with the exception of an occasional cargo from the old country, and some hard coal from Philadelphia. In other years we had a fleet of Steel Ships (Sealing Ships) which brought all the coal that was needed, and in addition to what was required for the trade and domestic requirements large stocks were kept on hand to supply any foreign going ships, especially during the fall and winter months. On account of the war however, this magnificent fleet of steel ships (seven in all) were sold to the Russian Government to be used in the White Sea as icebreakers, and thereby Newfoundland was deprived of the shipping which gave her an assured supply of coal. When the New Year came in there was held in stock in this city only about 4000 tons of coal for all purposes, and this amount held by three coal merchants, others sold out completely during Christmas

week. The price, which was \$7.60 per ton for soft coals, before the end of the year, jumped to \$10.80 per ton the second day of the New Year. It was then the Government stepped in and took charge of the supply, and instead of permitting the exorbitant price of \$10.80 to be charged reduced the price to \$8.00 per ton. The coal merchants threatened not to import any more coal if they were restricted in their charges. Matters then became grave, so much so that the Government were obliged to look to the British Admiralty for a large collier to bring a few cargoes of coal from Sydney. At present no collier is available, but will be later on.

In the meantime the Government has succeeded in getting a large steamer—the S. S. Alconda from Harmsworths of England, which ship is due in Sydney about January 20th, and due here January 26th, with 6000 tons of coal. In addition the Government has also chartered a large steamer from New York and she will be engaged for several months in the coal trade and together with the help of the colliers to be loaned by the Admiralty a little later on, the fear of a coal famine will be averted.

In view of such a calamity as a coal famine being merely averted from the country, the matter of the development of Newfoundland's coal deposits, is a subject which should engage the very earliest and most careful consideration of the Government of Newfoundland and her people too. That Newfoundland should be depending on any country for a coal supply, when she has abundance of coal within her own bounds, shows negligence and utter disregard for the welfare and advancement of the country not on the part of any one particular Government but all of them, and the apparent indifference and apathy of those of our people who should have interested themselves before to-day in a matter of such vital importance to the colony. In an article which I am preparing for the next issue of the Canadian Mining Journal I hope to show from data in my possession and the reports and opinions of some of the best mining authorities, that Newfoundland in addition to possessing inexhaustible supplies of iron and copper ores has also vast deposits of coal. "Show me a Geological map of a country, said the great Dr. Buckland, and I can point out where its future prosperity lies, and where its manufacturing and kindred industries will be established." This applies particularly to the country that is fortunate to possess supplies of coal.

Iron Ore. Work on the iron mines at Bell Island is going ahead full speed. Full crews of men are employed night and day, and immense piles of ore are being stacked for early shipment, as soon as navigation opens.

PORCUPINE AND KIRKLAND LAKE

LaBelle. The steam plant at the LaBelle Kirkland Gold mines, at Goodfish is now running. It consists of a compressor which will run from six to seven drills; two 65 H.P. boilers and a big hoist. The shaft is now down to 130 feet and will be carried on without delay while a cross cut on the 100 foot level will be continued with all speed.

Premier. The Standard Porcupine Mine has been sold to a company called the Premier Gold Mining Company of Boston. The Standard has been closed down for a number of years. Recently it was purchased for a few thousand dollars from the liquidator by one of the principal shareholders. In the early days of the Porcupine camp, the Standard was one of the most spectacular surface discoveries outside the Dome, the Hollinger, and other well known properties. A plant was rushed in to the claim and set up and work carried on, on a considerable scale, though not with much intelligence. Some diamond drilling was done and a core containing a good

deal of free gold was found, but drifting underground was never successful in discovering where this core came from. The slump in the undeveloped Porcupine prospects came along and the Standard shut down and has been shut down ever since.

Lucky Cross. Several offers have been made for the Lucky Cross Mine at Swastika. One of these was by Col. Hay, and associates. At the time of writing no deal has been definitely closed although it is most likely to be finished at almost any time.

Apex. A meeting of the Apex Porcupine Mines will be held in Montreal next Monday. It will then be decided whether an offer of fifteen cents a share for a block of the company's stock will be accepted. In this case the property will be likely to start up soon.

West Dome. All financial arrangements to handle the further development of the West Dome have been completed, but it is most unlikely that anything will be done on the properties until much later in the year. At the present time the plant needs a great deal of overhauling and this can be carried out much more cheaply when the weather is milder.

Jupiter. The raise from the 200 to the 300 ft. level at the Jupiter mine has been completed and the new plant is now being installed. An ore-house is also being built. All the mine will be in good shape for active development by the time the additional unit of the McIntyre mill is ready to handle ore from this property.

McIntyre. The quarterly statement of the McIntyre Mine showed that for the period ending December 31st a profit of a little over \$75,000 was made. It also stated that at the 750 foot level the diamond drill running at an angle of 37 degrees had cut an ore body fifteen feet wide of eighteen dollar ore. The shaft on the McIntyre Extension which is to serve as the main working shaft of the McIntyre group is now down to about 1000 feet. From the 1000 foot level cross cuts will be run to connect with the No. 5 shaft.

This cross cut should be instrumental in opening up several known veins on the McIntyre, while connecting the two properties. The completion of the addition to the McIntyre mill has been delayed owing to the non arrival of the tube and ball mills.

The tanks for the cyanide plant have been installed and it is expected that the whole of the new unit will be ready about the middle of February.

COBALT, GOWGANDA AND SOUTH LORRAIN

Temiskaming. The next annual report of the Temiskaming Mining Company will show that there has been mined during the year, about 1,600,000 ounces. Of this 280,000 ounces consist of ore broken on the stulls underground. The annual report will also show that despite the fact that most of the drills were running in development, costs were very low. This is the more remarkable since during all the time when silver was at such a low price drills were pulled off all veins showing ore and put on drifts that had either been abandoned by the old management or did not then show any ore.

There have recently been some very favorable developments in the mine. Drifting on the vein which has been yielding such remarkable ore, another high grade ore shoot has been encountered about 75 to 80 feet away. This is on the 500 foot level. Between the two points the vein yields a good width of milling ore. A very interesting, though so far not very profitable discovery has recently been made on the Gans claim on the 500 foot level. A body of quartz stretches clear across the face of the drift. This quartz is for the most part almost barren but patches

of high grade ore and smaltite occur in it, which make it profitable to hand pick and to run through the mill. The management of the Temiskaming decided that they would also sink their shaft through the diabase sill to the lower contact with Keewatin. Accordingly the shaft is now down 900 ft. and will be continued at the rate of about 100 ft. a month. Waste from this work is being used to back fill old stopes on the upper levels of the mine.

Beaver. The Beaver shaft is now down to 300 ft. where a station has been cut, and sinking has commenced again. The diamond drilling which was done about a year ago on the Beaver indicated that the Keewatin below the diabase sill would be found at about a depth of 700 ft. Progress is being made at the rate of about 100 ft. a month in sinking so that some information on this very interesting development should be forthcoming in May or June. The striking of ore in the Keewatin below the diabase sill would have revolutionary effects upon the Cobalt camp.

The Ophir Cobalt is now being pumped out and tenders are being asked for the sinking of the shaft from the 300 to the 600 ft. level. This will be the first work undertaken by the company in their new scheme of development.

The LaRose Mining Company is running a diamond drill from the 350 ft. level of the new shaft to discover the depth at which the Keewatin will be encountered. Discoveries on the Chambers-Ferland and the Nipissing adjoining make the subject very interesting to the LaRose. Last year the LaRose production was about 1,150,000 ounces. This is a good deal better than was anticipated last year, since no new ore bodies have been found. Profits amounted to about \$225,000 for the year and expenses to about \$405,000.

Power. All mines in the Cobalt camp have gone on a flat rate of \$50 per H.P. since the beginning of the year. This arrangement has been made between the mining companies and the Northern Ontario Light and Power Company and it is considered to be a considerable reduction. Previously all kinds of rates were in vogue, running from \$45 to \$85 a H.P.; now they are all uniform.

The Genessee Mining Company has resumed work on the United States Claim, to the north of the East claim of the Chambers-Ferland. The shaft will be sunk to the 300 ft. level before any exploration work is undertaken.

The McKinley Darragh has commenced to sink a winze below the 250 ft. level on the Cobalt Lake fault. This is not the first time that the company has done work on the fault, but although a little ore has been found it has never been sufficient to pay expenses.

Copper from Cobalt. For the first time in its history, a copper shipment was made from Cobalt. This consisted of a car load of chalcopryite ore from the Brewer and Price claim on the Montreal River, near Latchford. It was shipped by the Rand Syndicate to the States. The same syndicate is now working a copper prospect near the Sterling mine, a few miles west of mile post 76 on the T. & N. O. Railway.

The Crown Reserve Mining Company is sinking a winze on the large vein on the 500 ft. level. This vein was discovered some time ago, but the development was not rushed on it. Some patches of high grade ore have been found in it, but not sufficient to make it of paying grade. It is entirely in the Keewatin.

Trethewey. If the price of silver remains as high as it is to-day there is little doubt that the Trethewey will

commence work again, later in the Spring. There will be no hurry to start again, however, until the weather is moderate.

The South Bay Mining Company, working claims on Gowganda Lake is getting specifications and plans for the development of power at Gowganda. This scheme proposes the utilizing of the water of the East branch of the Montreal River. A tunnel will have to be bored for some distance from the East Branch to Gowganda Lake itself. Surveys are now being made and preliminary work undertaken. There are signs that Gowganda is not going to be so forsaken as it has been for the past two or three years. The Miller Lake O'Brien is working as usual and a fair body of milling ore has been found on the Millerett.

Barbara. On Wigwam Lake, the Barbara Silver Mines is setting up a plant. Mr. George Rogers has been in charge of the development of these claims for the past year and he has just returned from a trip to order machinery and other supplies in order to further develop the properties.

The Reeves-Dobie is now being worked by a Philadelphia Syndicate.

If the South Bay does persevere in its intention of putting in a power plant, it will undoubtedly induce many companies to resume.

COPPER.

New York—Developments in the copper-market Friday Jan. 21, were sensational. Quotations for spot copper ranged above 25 cents a pound. One small lot of copper for February delivery sold as high as 30 cents a pound. This was an isolated case, and does not reflect actual market conditions. The large agencies made no sales above 25 cents, although opportunities presented would have enabled them to sell their product above that level.

It is the desire of the large producers to keep metal prices at a reasonable figure, and attempts to sell copper at what they regard as exorbitant prices will be discouraged.

With consumption running at a rate that has exhausted surplus stocks producers realize the seriousness of the situation, and their object is to stabilize conditions by holding prices at a level that will not discourage consumptive demand.

Boston, Jan. 24—Copper consumers were on the job early Saturday with telegrams and telephone communications with New York as a result of Friday's extravagant stories wired out from that city in relation to copper prices. There were sales Saturday for April shipment at 25½ cents a pound.

An old-time boom in the copper shares is one of the predictions made during the present bull market that have not come true. And this is not at all due to a lack of bull ammunition. The copper industry gained great benefit through the war demand for metal while the rise in the shares has not been more than average. Where the trouble lies is puzzling a good many persons, but it is obvious that the public has never warmed up to the coppers. A feature of this situation is the attitude taken by the Boston market in coppers. New England speculators have shown no more indication of enthusiasm over the market in coppers than have people of New York.

A question constantly asked is, why doesn't Boston come in? Boston was the centre of former bull periods in the copper stocks—and also lost enormous sums in the last big boom. People with a first-hand knowledge of the industry consider the disparity between trade conditions and the stock market as past all understanding.

GENESSEE MINING CO.

It is the intention of Manager L. F. Steenman of the Genessee Mining Company to continue the present 60-foot shaft to a depth of 300 feet before crosscutting, and if ore is not located, to sink to 375 or 400 feet, a new blacksmith shop, hoist-house, powder and store houses are erected on the property, and a new shaft house will be built shortly. A small gang of men is now employed on the property, and it is the intention to prosecute development work energetically.

The owners of the Genessee are optimistic of the outlook, the recent developments at the Chambers-Ferland having enhanced the prospects for the Genessee. The management is making connection with the Chambers-Ferland air line, which work was completed this week. The property will be undertaken at once, and the pumping out of the shaft will be commenced as soon as the air is available for the purpose.

The shaft on the property was sunk on a 4-inch vein of low-grade, and the present known vein system, together with the possibility of encountering the rich ore from the Chambers-Ferland, has encouraged the Genessee to institute a policy of thorough development.—Cobalt Nugget.

COBALT SHIPMENTS

Cobalt, Jan. 22.—The present week is the first for some time in which there were no shipments of bullion from the camp. The ore shipments, however, were considerably higher. Six mines shipped seven cars and all went to Canadian smelters, with the exception of one from McKinley-Darragh which went to Perth Amboy, N.J. In the list Casey Cobalt is included, shipping one car from New Liskeard. Nipissing led in tonnage, shipping two cars, both of them going to Welland, Ont. The shipment figures show a total of 535,892 pounds shipped for the week ending last night, against 465,943 pounds shipped the week previous.

Ore shipments for the week were as follows:

MINE.	POUNDS.
Nipissing.....	130,728
LaRose.....	87,100
McKinley-Darragh.....	69,077
Mining Corporation, Cobalt Lake.....	86,609
Peterson Lake, (Seneca ore).....	83,492
Casey Cobalt.....	80,820

Total..... 537,829

Bullion shipments for the year, to date are:

	Bars.	Ounces.	Value.
Nipissing.....	214	251,675.15	142,196.75
Cr. Reserve.....	29	29,000.00	17,000.00

THE COPPER ORDER.

The following is a copy of the order issued by the British government setting a £100 (21 cent) limit on certain copper purchases:

I am directed to inform you that the minister of munitions considers it desirable to exercise a closer check upon the purchases of copper made by contractors to His Majesty's government for the purpose of carrying out munitions orders.

I am to request, therefore, that from the date of this circular you will observe the following rules in regard to such purchases:

(1) Orders up to and not exceeding 50 tons may be placed in the usual way without reference to the ministry.

(2) No order for "best selected" or "electrolytic" brands of copper should be placed at prices exceeding £100 per ton, without first consulting the director of materials, armament buildings.

MARKETS

NEW YORK MARKETS.
CONNELLSVILLE COKE

JANUARY 24th, 1916.

Furnace, spot	5.00
1st half 2.35—2.50. Year 1916	2.25—2.35
Foundry, prompt	3.50—4.00
Contract	3.00—3.50.
JANUARY 24th, 1916.	
Straits Tin, b.o.f.	42.25
Copper—	
Prime Lake, nom.	25 00 to 25 50
Electrolytic, nom	25 00 to 25 50
Casting, nom.	24 00 to 24 25
Lead, Trust price	6 10
Lead, outside.	6 10
Spelter, prompt western shipment	19 05 to 19 30
Antimony—	
English brands, nominal	
Chinese and Jap.	42.50 to 43.00
American	42.50 to 43.00
Aluminum—	
No. 1 Virgin 98-99%	53.00 to 55.00
Pure 98-99% remelt.	51.00 to 53.00
No. 12 alloy remelt	43.00 to 45.00
Nickel	45.00 to 50.00
Cadmium nominal	\$1.25 to \$1.50
Quicksilver, nominal	\$275.00
Platinum—	
Nominal	\$88.00 to 100.00
Cobalt (metallic)	\$1.25
Silver (official)	57 5-8

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper	base 31.50
Copper wire	base 26.00 to 26.50
High sheet brass	base 34.00 to 36.00
Seamless brass tubing	38.00 to 40.00
Seamless copper tubing	38.00 to 40.00
Brazed tubing	38.00 to 40.00
Brass wire	34.00 to 36.00
Brass rods	34.00 to 36.00
Sheet zinc, f.o.b. smelter	23.00

TORONTO MARKETS.

JANUARY 26th, 1916

(Quotations from Canada Metal Co., Toronto)

Spelter	21 cents per lb.
Lead	7½ cents per lb.
Tin	47 cents per lb.
Antimony	48 cents per lb.
Copper casting	26 cents per lb.
Electrolytic	26 cents per lb.
Ingot brass	yellow, 13c.; red, 15c. per lb.

JANUARY 26th, 1916.

(Quotations from Elias Rogers Co., Toronto)	
Coal, anthracite	\$8.00 per ton
Coal, bituminous	\$5.25 per ton

STOCK QUOTATIONS

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto).

As of close, January 24th, 1916

New York Curb.

	Bid	Asked
Atlanta	.21	.22
Canada Copper	1.93½	2.00
Am. Marconi	4.00	4.25
Belmont	4.25	4.37½
Goldfields Cons.	1.00	1.06¼
International Nickel	2.14	2.15
Jim Butler	.93	.95
Jumbo Extension	1.31¼	1.37½
Riker Hegeman	5.50	5.75
Standard Silver-Lead (B.C.)	1.75	1.81¼
Stewart Mining	56¼	62½
Tonopah Extension	4.43¼	4.50
Tonopah Merger	55	60
Tonopah Mining	6.75	7.00
United Profit Shar.	2.00	2.12½
West End. Cons.	79	81
Anglo-Amer. Oil	16.75	17.25

Submarine Corp.	38 25	39 40
Kennecott Copper	54 25	54 7½
Standard Oil of N.J.	5 07	5

Porcupine Stocks

Apex	7.5-8	7.
Dome Consolidated	19	33½
Dome Extension	33	28.
Dome Lake	26	28.00
Dome Mines	27.50	75.
Foley O'Brien	60	01¼
Gold Reef	29 00	29.75
Hollinger	42	20¾
Homestakes	20	91.
Jupiter	90½	31.
McIntyre	29	12½
McIntyre Extension	12	87.
Moneta	83	41¼
Porcupine Crown	4 1-8	2½
Porcupine Imperial	1½	74.
Porcupine Tisdale	73	6.
Porcupine Vipond	5½	18.
Preston East Dome	16¼	16¼
Teck Hughes	15½	23½
West Dome	23	
West Dome Consolidated		

Cobalt Stocks.

Bailey	4 7-8	5.
Beaver	40.	41½.
Buffalo		90.
Chambers Ferland	28½	28½
Coniagas	4.55	4.75
Crown Reserve	52.	54¼
Foster		7½
Gifford	7.	7¼
Gould	7.	
Great Northern	4½	4.7-8
Hargraves	3½	5.
Hudson Bay	30.	35.
Kerr Lake	4.45	
LaRose	67.	70.
McKinley	40.	42.
Nipissing	7.25	7.50
Ophir	7½	8½
Peterson Lake	31¼	32.
Right of Way	5.	6¼
Seneca Superior	73.	78.
Shamrock Cons.	18.	18½
Silver Leaf	2.5-8	2½
Temiskaming	68.	69.
Trethewey	16.	17½
York Ontario	½	1
Wettlaufer	8.	8½.

SILVER PRICES

	New York cents	London Pence
January		
10	56½	
11	56¾	26 15-16
12	57	27
13	56 7-8	27
14	57	27 1-16
15	56 7-8	27
17	56 3-8	26 3-4
18	56 5-8	26 7-8
19	56 5-8	26 7-8
20	56 3-4	26 15-16
21	56 7-8	27
22	57 1-4	27 3-16
24	57 5-8	27 5-16

CROW'S NEST.

Summarizing the year's results of the Crow's Nest Pass Coal Company, for The Financial Post, Elias Rogers, the president, says that the output of coal was about 877,000 tons and the output of coke about 266,000 tons. "Since Jan. 1, 1915," declares Mr. Rogers, "we have paid off all our indebtedness and have now a substantial balance in the bank. All bonds against the subsidiary companies have been paid and there are now no bonds outstanding against any of the companies, and no preferred stock. As far as we can judge, the prospects for the coming year are quite as good if not better than the past year."

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario Cohen, S. W. Campbell & Deyell. Carter, W. E. H. Ferrier, W. F. Forbes, D. L. H. Gwillim, J. C. Hassan, A. A.	Haultain, H. E. T. Segsworth, Walter E. Smith, Alex H. Smith, Sydney. Maurice W. Summerhayes. Tyrrell, J. B.	Quebec Burchell, Geo. B. Cohen, S. W. DePencier, H. P. Hardman, J. E. Hersey, Milton L. Johnson, W. S. Smith, W. H.	British Columbia Brown & Butters. Fowler, S. S. FOREIGN-New York Canadian Mining & Exploration Co., Ltd. Colvocoresses, Geo. M. Dorr, Jno. V.N. Hassan, A. A.
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ENGINEERS, METALLURGISTS AND GEOLOGISTS.

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BURCHELL, GEO. B. Mining Engineer Lignite and Bituminous Coal Mining Examinations and Reports 505 MCGILL BLDG., MONTREAL Cable Address "Minchel" Phone Main 6737	FOWLER, S. S. Mining Engineer, NELSON, B. C.	JOHN V. N. DORR Consulting and Metallurgical Engineer 17 Battery Place and New York City First National Bank Building Denver, Colorado
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CARTER & SMITH Consulting Mining Engineers Hermant Building, 19 Wilton Ave. TORONTO W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.	GUESS & HAULTAIN Mining & Metallurgical Engineers 123 Bay Street TORONTO CANADA	SUMMERHAYES, MAURICE W. Mining Engineer, Manager Porcupine-Crown Mines, Limited Timmins - Ont.
COHEN, SAMUEL W., E. M. Consulting Engineer, Room 601, Dom. Express Bldg. Montreal General Manager, Crown Reserve Mining Co. Ltd. Cobalt, Can.	GWILLIM, J. C. Consulting Mining Engineer, KINGSTON, ONT.	TYRRELL, J. B. Mining Engineer, 534 Confederation Life Building. TORONTO, - - CANADA.

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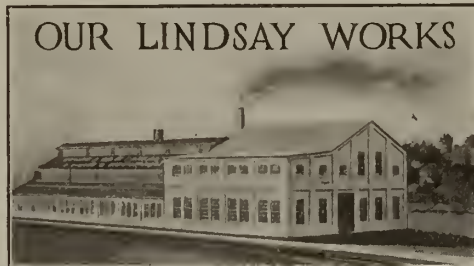
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VOL. XXXVII

TORONTO

No. 4

In This Issue:

Porcupine Gold Deposits

The Nickel Refinery Letters

Recruiting Miners in Nova Scotia

*Rock Drilling in Calumet and Hecla
Mines*

Mining in Slocan District, B. C.

CANADA

DEPARTMENT OF MINES

HON. P. E. BLONDIN, Minister.

R. G. McCONNELL, Deputy Minister.

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Recent Publications

The Nickel Industry: with special reference to the Sudbury region, Ont. Report on, by Professor A. P. Coleman, Ph.D.

The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.

The Bituminous Sands of Northern Alberta. Report on, by S. C. Ellis, M.E.

Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.

The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.

The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.

Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.

Electro-thermic Smelting of Iron Ores in Sweden. Report on, by A. Stansfield, D.Sc.

Non-metallic Minerals Used in Canadian Manufacturing Industries. Report on, by H. Frechette, M.Sc.

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Ceramic Laboratory.—Equipment is such that complete physical tests on clays and shale of the Dominion can be made, to determine their value from an economic standpoint.

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Applications for reports and particulars relative to having investigations made in the several laboratories should be addressed to The Director, Mines Branch, Department of Mines, Ottawa.

GEOLOGICAL SURVEY

Recent Publications

Memoir 34. The Devonian of Southwestern Ontario, by Clinton R. Stauffer.

Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

Memoir 56. Geology of Franklin Mining Camp, British Columbia, by C. W. Drysdale.

Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.

Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.

Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.

Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.

Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.

Memoir 73. The Pleistocene and Recent Deposits of the Island of Montreal, by J. Stansfield.

Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.

Memoir 76. Geology of the Cranbrook Map-area, British Columbia, by S. J. Schofield.

Memoir 77. Geology and Ore Deposits of Rossland, British Columbia, by C. W. Drysdale.

Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.

Memoir 79. Ore Deposits of the Beaverdell Map-area, by L. Reinecke.

Memoir 81. The Oil and Gas Fields of Ontario and Quebec, by W. Malcolm.

Memoir 82. Rainy River District of Ontario. Surficial Geology and Soils, by W. A. Johnston.

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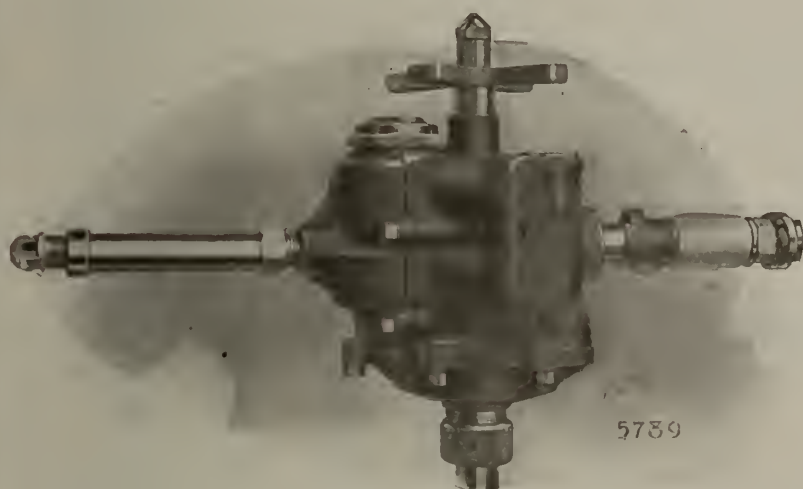
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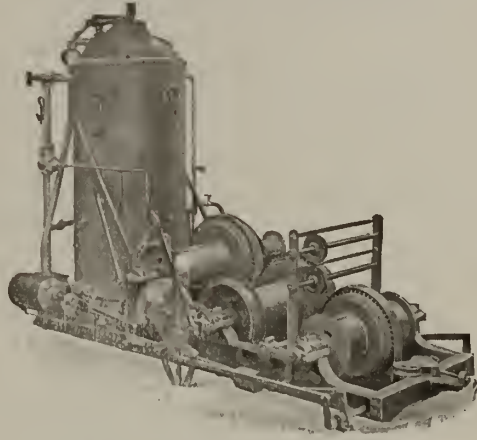
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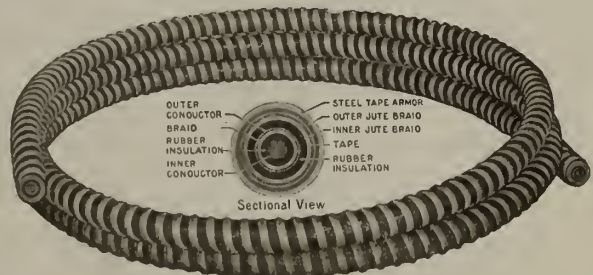
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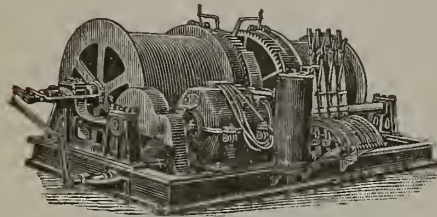
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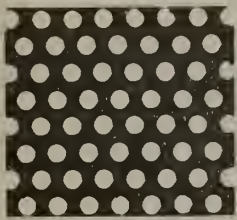
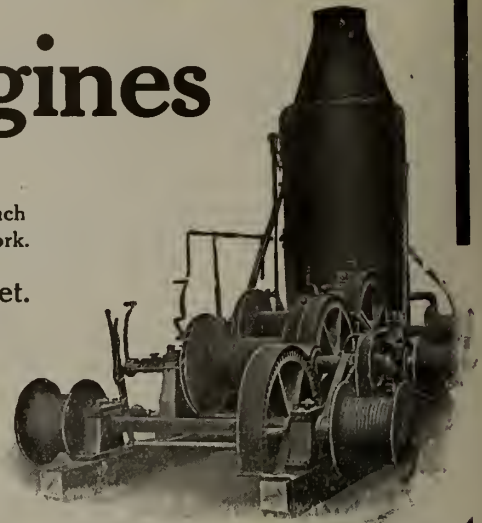
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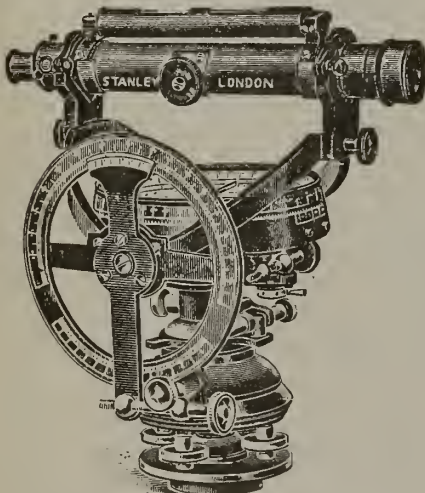
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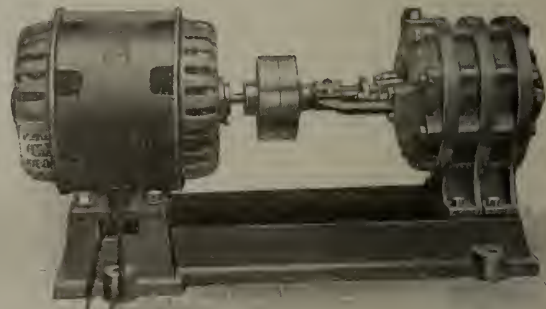
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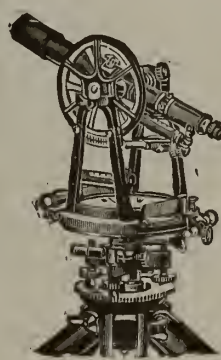
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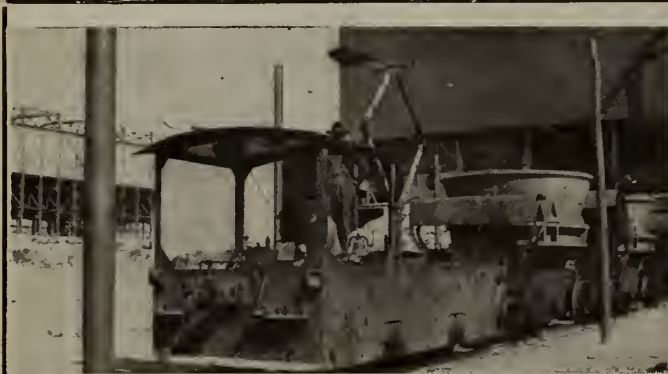
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, February 15, 1916.

No. 4

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EFFICIENCY IN MINING

It is never safe for one in charge of mining operations to assume that he is doing things in the best possible way. There is always a better and cheaper way which would yield the mine owners a larger profit.

The mine operator is expected to utilize the best known methods, to adapt them to his special needs and to improve on them. He is called upon to lower the cost of production without lowering the wages of employees. Such things are being accomplished in mining districts everywhere, and nearly every operator succeeds in making some improvements. The struggle against costs is always going on.

Occasionally the attempts to increase efficiency meet with very great success. An example of this is the development of the drill bit which during the past few months has doubled the rate of drilling in the mines of the Calumet and Hecla Company and increased the miners' efficiency by forty per cent. It has added to the production per man per day, increased the profit per ton and enabled the miner, without extra work, to earn higher wages. A description of this bit and some account of the results obtained with it, will be found elsewhere in this issue of the Journal.

The success of the Calumet and Hecla Mining Company is largely due to the ability of its officers and the men in their employ. General Manager MacNaughton has a record to be proud of. He is undoubtedly one of the most successful mine managers in America. He is ably assisted by General Superintendent John Knox Jr., who is in charge of the underground work.

A few years ago at the Superior mine, one of the Calumet and Hecla subsidiaries, Mr. Ocha Potter, the mine superintendent, began an efficiency campaign. He enlisted the services of several recent graduates of the Michigan College of Mines. These men began as miners and soon developed into efficiency engineers. The company recognized the value of Mr. Potter's work and appointed him chief efficiency engineer. His assistants, on graduating from the Superior mine, were attached to the staffs at other mines operated by the company. Among other things, they were largely instrumental in making the one-man drill a success in Michigan.

The efficiency department has been a very important factor in cutting costs. It has to its credit the development of many labor and time-saving devices. It had greatly increased the efficiency of the miner. The very great increase due to the improved drill bit is therefore a distinct triumph. Those responsible for it are deserving of great praise.

THE RECRUITING OF MINERS

There are few classes of men in Canada who have responded so well to the call for recruits as have the employees of mining companies. Men accustomed to meet danger in their daily tasks are not only quick to recognize danger from a new source, but willing and ready to meet it and to protect themselves and their comrades. They take their new responsibility easily and go forth to fight the Huns not only because they consider it their duty, but because they enjoy the prospect of being at the front where the danger is great and where they will match their skill and courage against that of the foe.

The miners at the front, and there are very many there now, have given a good account of themselves. Their experience has peculiarly fitted them for the work in the trenches. Their value as soldiers has been recognized and naturally the demand for miners has increased.

Since mine employees enlist so readily and make such useful soldiers, recruiting is brisk in the mining centres. Those in charge of properties have encouraged their men to enlist and are proud of their honor lists. The recruiting has seriously affected mining operations, of course. But the mining companies have made no complaint on account of their own losses and indeed it would ill become them to do so. Other industries have suffered similarly.

But many mining men do not hesitate to state that they consider the present methods of recruiting undesirable and not in the best interests of Canada and the Empire. Men who are engaged in the production of necessary materials are being taken from their work without substitutes being found to fill their places. The seriousness of this is well pointed out in this issue by our Nova Scotia correspondent, Mr. F. W. Gray.

Mr. Gray, as our readers well know, would not bring up such a matter for any but the best of reasons. The Canadian public seems to understand the necessity of producing large quantities of grain during the war; but to be comparatively ignorant of the need of mine products. Mr. Gray makes clear the situation in Nova Scotia and the need for governmental enquiry and action.

The annual meeting of the Canadian Mining Institute will be held in Ottawa March 1st, 2nd, and 3rd. Arrange your work so that you can attend. It is well worth while.

The management of the Buffalo mine has taken a leading part in developing processes for the treatment of the ores of the Cobalt district. Much interest is now being taken in flotation of Cobalt silver ores and it is not surprising that the Buffalo is among the first to put in a flotation plant. We hope that it will prove successful.

AN INACCURATE REPORT

The publication "Petroleum and Natural Gas Resources of Canada," by Frederick G. Clapp and others, Vol. II., just issued by the Department of Mines at Ottawa, is a typical example of the results of the disease which might be called "voluminosis" which is afflicting so many of our public reports. It may possibly be of service to point out some of the ways in which this disease manifests itself. In the first place the volume is made imposing in thickness by the simple expedient of leaving a very large margin around the printed matter on each page. Thus, the size of the page is $9\frac{3}{4} \times 6\frac{1}{4}$ inches. With these dimensions the text could easily occupy $7\frac{3}{4} \times 5$ inches or an area of $38\frac{3}{4}$ square inches, whereas, it actually only covers $6\frac{1}{4} \times 4$ inches or 25 square inches. Thus approximately one-third of each page is not utilized and thereby, of course, the thickness of the volume is correspondingly increased.

A more serious result of the craze for volume is seen when we come to examine into the matter of the work in question. It soon becomes evident that accuracy has been sacrificed ruthlessly. Thus, a glance at the map showing the gas and oil fields in south-western Ontario, proves that neither in the form or position of these fields has any consistent attempt at accuracy been made. Almost without exception the gas and oil fields are given an egg shape on this map, so that the whole presents the appearance of a collection of bird's eggs of various sizes, and is actually not much more useful than a last year's bird's nest. These fields have not this form in nature, but are quite irregular. The Petrolia oil field is delineated in the form of an elongated egg or castor oil capsule, actually it is shaped like a ham. Every township in the counties of Welland, Haldimand and Norfolk, fronting on Lake Erie had its productive gas wells. This is not shown by the map. None of the egg-shaped areas indicated in Haldimand county are extended down to Lake Erie, whereas, the facts are that for some miles in length not only are there scores of gas wells drilled along the lake shore, but also the bed of the lake was leased in front of the townships of Rainham and Walpole and several dozen wells were drilled for gas in this territory with good results. The statement is even made in the text (p. 142) that many wells had been drilled in Lake Erie. Of course, a little thing like a contradiction between the text and the map would not affect the hunter after volume.

The positive assertion is made (p. 222) that no gas field has ever been found in Wentworth county. There are, however, quite a number of good gas wells in Binbrook township, in this county. Here the text and map are in accord, but both are wrong.

In reading the text of the volume under discussion one is not inspired with confidence in the care taken by the authors. A great deal of it is, of course, not readily capable of being checked except by one having

special knowledge of the matter dealt with. Some things, however, are obviously wrong. Analyses are given in several cases which cannot be correct, as they show constituents which do not exist in natural gas. Carbon monoxide, hydrogen and heavy hydrocarbons or illuminants it may safely be said are never found in natural gas. The best chemists, even twenty or thirty years ago, never gave them. This has been thoroughly demonstrated by Burrell and Seibert (Bulletin 42 U.S. Bureau of Mines). Yet we find substantial percentages of these things cheerfully given by our authors. In a couple of instances a mark of interrogation is put after the constituents under discussion as on p. 321, but there can be no doubt that an analysis of natural gas showing 8 per cent. hydrogen should be discarded altogether as we would ignore an analysis of a steel rail if it gave 8 per cent. of lead or tin. In other cases as on pp. 334 and 340 these impossible constituents are given without any question mark. Surely there must be some way of curbing this kind of thing before we are smothered by the mass of publications ever flowing from the press.

MR. BURROWS' REPORT ON THE PORCUPINE AREA

The Ontario Bureau of Mines has just issued a third report on the Porcupine Gold Area, by Mr. A. G. Burrows. It is accompanied by two excellent geological maps; one, on a scale of 2,000 feet to one inch, showing the greater part of Tisdale and Whitney townships, and one, on a scale of 1,000 feet to one inch, showing in greater detail the two chief producing centres.

During the past few years Mr. Burrows and his assistant, Mr. P. E. Hopkins, have done a great deal of careful work in Northern Ontario gold fields and particularly in the Porcupine area. The result of their recent field work is now available and anyone interested in the district should find the maps and report very useful. The maps are a credit to these gentlemen and to Mr. W. R. Rogers, the Bureau's topographer.

Elsewhere in this issue will be found some extracts from Mr. Burrows' report, a copy of which may be obtained by application to the Bureau of Mines, Toronto.

With this publication on the Porcupine Area are bound a description of the Kamiskotia Lake Area, by Messrs. Burrows and Hopkins, and a short article on Water Powers in the Porcupine Area, by Mr. W. R. Rogers. Water powers are a very important factor at Porcupine, as in nearly all Ontario mining districts.

According to the "Toronto World", "the nickel company's profit was over \$20,000,000 last year, not to mention a free stock dividend to the shareholders." If the World's statement is reliable, and if "the company" means the International Nickel Company, that company's stock is selling at an absurd figure. We incline to the belief that the World's estimate of profits is a little high.

In view of the frequent statement that mining uses up our natural resources, while agriculture does not, the following notes by Mr. W. J. Dick, of the Commission of Conservation, are interesting:

"In 1914 the wheat production of Canada amounted to 158,223,000 bushels—the average yield per acre being about 15.37 bushels. Allowing two pounds of straw as removed for every pound of grain, and taking the average analysis of wheat and straw, the following amounts of plant-food were removed from the soil during that year by the wheat crop alone: Nitrogen, 300,000,000 pounds; phosphoric acid, 95,000,000 pounds; potash, 137,000,000 pounds.

"While the virgin soils of Western Canada and especially the very deep rich soils of Manitoba, continue for years—and in some cases for many years—to produce heavy yields even under continuous cropping, they are by this process gradually depleted, and as the supplies of plant food become reduced, the signs of exhaustion will be manifested in decreasing returns. As a matter of fact this depletion is already manifesting itself. To maintain fertility, the valuable constituents taken from the soil must be returned to it."

Every intelligent farmer knows that each crop takes valuable constituents from the soil. Fortunately we can, by mining, replace some of the more necessary ones. We mine phosphate in the Southern States and make sulphuric acid from pyrite mined in Ontario to treat this phosphate to make a soluble substitute for the phosphates removed from the soil by the crops. The farmer is aided by the mining industry in more ways than he realizes.

Elsewhere in this issue will be found a provisional programme of papers to be presented at the annual meeting of the Canadian Mining Institute. The papers on concentration of ores by flotation should prove especially interesting.

INTERNATIONAL ENGINEERING CONGRESS 1915

The Committee of Management, International Engineering Congress, 1915, announces that the volume on Mechanical Engineering is ready for distribution and the members who have subscribed to this volume will soon receive it.

The other volumes will be issued as rapidly as possible. Owing to the large amount of material to be reprinted, and the thousands of copies to be bound, the work cannot be carried on with greater speed. However, it is hoped that within two months the entire set will be completed.

Members who did not send in their final selections may be disappointed in not securing all the volumes they might have had in mind, and at this date the Committee has decided to close the lists for certain volumes which have been sent to the press. It may be possible to supply members who would apply at this late hour with copies of volumes which have not gone to press.

TOUGH-OAKES.

According to the "Cobalt Nugget" the dove of peace was conspicuous by its absence at the meeting of the Tough-Oakes Mining Co., which was held in the company's offices two weeks ago. The cause of dissension among the shareholders, as far as can be learned, was a desire for a new directorate and the possession of a controlling interest in this gold mining company. When the solicitor of the company, Mr. Kearney, was asked for a report of the meeting by a Nugget representative, that gentleman stated that there was no annual meeting held. "Not enough shareholders represented to make a quorum," was the way he put it. Only three of the directors were present.

When the hour of opening the meeting had arrived Mr. Foster announced that as the number of shareholders necessary for a quorum were not present any proceedings on the part of the meeting would be illegal, according to the by-laws of the company. The shareholders, or some of them at least, evidently were of a different opinion and went on with the business.

In the election of the directors the following gentlemen were elected: Messrs. Harry Oakes, R. J. Robins, J. W. Morrison, W. H. Wright, J. B. Holden, Albert Burt, and J. Y. Murdock. At a subsequent meeting Mr. Oakes was appointed president, Mr. R. J. Robins, vice-president, and Mr. Albert Burt, secretary-treasurer.

In an interview, Mr. Foster stated emphatically that there had been, legally, no meeting of the company. According to the by-laws of the company, one-third of the issued stock must be represented before a stockholders' meeting could be held and business transacted. Before the meeting the number of shares represented was counted up and it was found that less than one-third of the issued stock was represented. Mr. Foster states that he called attention to the fact but the form of the meeting was gone through by a number of those present notwithstanding. Mr. Foster stated that he remained in the chair throughout the meeting, but as the business done was not in accordance with the by-laws, for the reason stated in the foregoing, another meeting will have to be called at a later date, the business done in a regular way, and the officers for the year elected.

DAVIDSON.

The five Davidson claims in northern Tisdale are under option to Mr. R. H. Lyman until April 1st. These claims include the Davidson, upon which the Crown Chartered did all the development in the last year they were working, but they are now entirely released from that company. A shaft was sunk and a body of milling ore was developed on two levels. How extensive that milling ore is was not discovered before the Crown Chartered ran out of funds and the work ceased.

The claims are in two groups, one adjoining the Crown Chartered claims and one about half a mile to the north.

Mr. Lyman has his option direct from the court winding up the Crown Chartered affairs. There is yet some money owing from the old company to various creditors, but Crown patents will be issued when the first payment is made on the property.

It is most probable that New York capital will be interested.—Northern Miner.

PIONEER MINER IS DEAD.

Kenora, Feb. 7.—A pioneer mining man, Mr. Oliver Daunais, died here Saturday after a short illness, at the age of eighty years. The early portion of his life was spent in Port Arthur district, when Silver Island mine was startling the mining world about 1879. At one time he was owner of the Silver Mountain, Beaver and Rabbit Mountain mines, three of the most promising silver properties in the district. About 1894 he was attracted to the Lake of the Woods region, where he secured several promising gold claims. He leaves a wife, four daughters and three sons.

KITCHIGAMI GOLD

According to the "Northern Miner," a Michigan company called the Kitchigami Gold Development Company is diamond drilling the western group of Gordon claims at Goodfish upon which they have an option. A diamond drill has been taken in and is now running. The object of this work is to pick up the extension of the Costello vein system, one of the four claims taken up adjoining the Costello.

The directorate of this new company includes John Daniel, Dr. John McRae, Chas. Chynoweth, James T. Fisher, and Edwin J. Hall, all of Calumet; Henry Baer, of Hancock; and John A. Doelle, of Houghton.

Mr. C. T. Botsford, who makes his headquarters in Haileybury is in direct charge of the work. The company was organized under Arizona state laws with a capital of \$300,000 divided into 150,000 shares of a par value of \$2.

NIPISSING.

Cobalt, Feb. 9.—During the month of January Nipissing mined ore of an estimated value of \$169,802, and shipped bullion from Nipissing and Custom ores of an estimated net value of \$148,730. The high-grade mill treated 81 tons and the refinery shipped 251,676 ounces of fine silver. The low-grade mill treated 5,278 tons.

McIVOR.

Toronto, Feb. 10.—Two 50 h.p. boilers and a 5-drill compressor were shipped last week into the McIvor property in the western extension of Kirkland lake. The property was first discovered last summer and consists of six claims. It has one well defined lead which has been stripped for a considerable distance and the shaft which was done by hand, is down 30 feet.

DOMES.

The regular quarterly dividend of 50 cents per share on Domes has been declared. It is payable on March 1st to shareholders of record Thursday, Feb. 17. Dividend disbursements will amount to \$200,000 and will make a total of \$600,000 paid on the common stock, or 15 per cent.

DOMES LAKE.

The cyanide plant for the Domes Lake Mining Co. was shipped from Toronto some time ago, and its arrival is expected there any day now.

McINTYRE.

Operating profits of the McIntyre-Porcupine Gold Mines during January are officially given out as \$38,400.

THE CARR BIT

A DRILL BIT WHICH HAS INCREASED THE EFFICIENCY OF CALUMET AND HECLA MINERS 40 PER CENT.

The Calumet & Hecla and subsidiary companies operating in the Michigan copper district are producing about 660,000 tons ore per month and have an enviable record for efficiency in all departments. The announcement therefore that the use of a new type of drill bit has increased efficiency by 40 per cent. well deserves the attention of those who are responsible for the economical operation of mines. Knowing that our readers would want to hear more about this bit,

The theory of the bit is that if the two edges of the wings of the bit are kept out to the full gauge diameter of the cutting edge, then these edges act as reamers—the cutting edges doing the rough chipping—and the diameter of the hole is maintained. This makes it possible to start a hole with a very small diameter and drill it to a considerable depth at a great relative speed.

The experimental work in the efficiency department early proved the theory that the drilling speed of any given machine under constant conditions varied inversely with the volume of rock cut, or in other words with the square of the diameter of the hole.

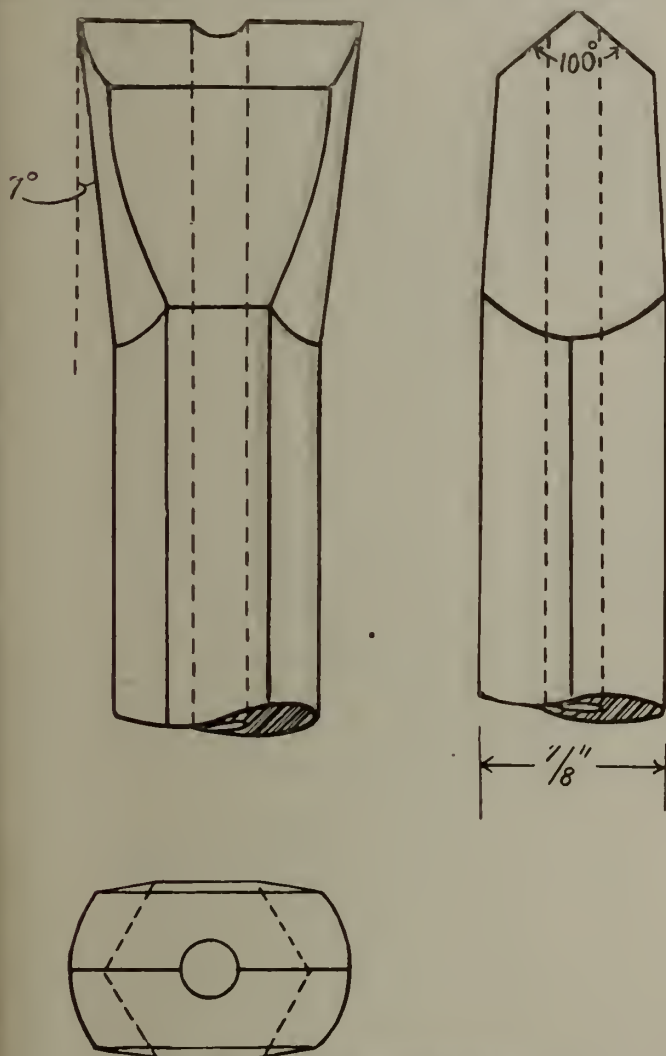
It is the possibility of starting a hole with a very small diameter and drilling it to a considerable depth with but very small loss in gauge that makes the Carr bit valuable. As a matter of fact it is found that the Carr bit drills but very little faster than the ordinary cross bit if the gauges are the same.

The reaming quality of the wings of the Carr bit make it possible to change the gauge of the drills only one-sixteenth inch for each 22 inch run of steel on the amygdaloid lode mines and in the case of the Oseeola lode the change in gauge is only one-sixteenth inch every second run, or 44 inches. On the Calumet conglomerate lode, which is very hard, the gauge is changed one-sixteenth inch every 12 inches, one foot being the standard run on this lode. A "Cross-Carr" bit, built on the same principle as the Carr bit, has recently been developed for use on the conglomerate lode. It is found that it "fitchers" less readily than the single Carr bit owing to the tendency of the latter to wedge in the fissures and cracks which are characteristic of the stopes in this lode.

Holes are also being drilled to a greater depth than was practicable with the bits formerly in use. Present practice is to use 12 and 14 ft. drills in stopes on most of the amygdaloid lodes and 14 and 16 ft. drills on the Oseeola lode. The 10 ft. drill is the longest in use on the Calumet conglomerate lode, because of the "fitchery" character of the ground. It has been found that these longer holes are much more economical in the use of powder, saving about 20 per cent.

Carr bits drilling a "rounder" hole, it is easier to extract drills from the holes and therefore it was soon found advisable to use anvil block chucks with plain shanks on the steels, thus doing away with the necessity of putting lugs on the drills as had been the practice since the introduction of the Leyner machine. Drill breakage and the resulting loss of drill steel has consequently been greatly reduced. The anvil block chuck and the resulting plain shank on the drill steel made it possible to use smaller and lighter steel and therefore still smaller holes than were practicable with the 1 1/4 inch round steel formerly in use.

One-inch hexagon steel has therefore become the standard at the Calumet and Hecla and subsidiaries, except on the Oseeola lode and at the Superior mine where conditions were found to justify the use of seven-eighths inch hexagon steel. The Oseeola lode has a present output of about 150,000 tons of ore per month and the Superior mine a little less than 20,000 tons. The amygdaloid mines using 1 inch steel have a monthly output of about 340,000 tons. The conglomerate product is at the rate of about 150,000 tons, but



Single Carr Bit on 1 in. hexagonal steel

we asked for a description of it and some account of the results obtained.

Mr. James MacNaughton, second vice-president and general manager of the Calumet & Hecla Mining Company, has kindly sent us, for our readers, the following notes prepared by Mr. O. Potter, chief efficiency engineer of the company.

The Carr bit was first called to the attention of the Calumet and Hecla Mining Co. by the Ingersoll-Rand Co. who had used it with considerable success at a mine in the south. As originally designed it did not prove to be very efficient in the Michigan copper mines and it was only by changing the various angles of the bit, reducing the size of drill steel used, and insisting upon very accurately made bits, that satisfactory results were finally obtained.

the new bits have as yet been only partly introduced on this lode.

The drilling speed of the Carr bit on the smaller steels now used is just about double that of the old crossbit on the $1\frac{1}{4}$ inch round steel formerly used. By "drilling speed" is meant the depth of hole drilled per minute of **actual reciprocating time**. Since much of the work of the miner—such as rigging up, barring

about equal to the total efficiency of the miner of four years ago.

During the experimental work on the Osceola lode several machines were kept stoping with Carr bit drills, seven-eighths inch hexagon, using 16 ft. drills and a constant gauge all the way down. That is, the starter and 16 ft. drill had the same gauge. These bits were all hand-made, however, and it was decided



Operating a Leyner Drill with old style bit in, the Calumet and Hecla Mine

loose, changing drills, etc.—is not at all affected by the bit, his efficiency is not increased in proportion to the increase in drilling speed of the bit. However, there has been an actual increase in every mine, after a few weeks use of the bit, of about forty per cent. in actual efficiency, and this without any extra effort on the part of the miner. The miner, however, has been made a beneficiary of the improved conditions and is receiving considerably better pay as a result.

During the past four years many improvements have been made in drilling methods among the Michigan copper mines and it is rather interesting to note that the increase of 40 per cent. due to the Carr bit is just

that for general conditions it would be better to give the drills some slight change in gauge in order to allow the blacksmith a little lee-way. In actual practice the drill sharpener is expected to keep the gauges accurate to one-thirtysecond inch, and this is being done very successfully.

Considerable difficulty was experienced at first in making these bits of the required accuracy owing to the peculiar warped surface of the side of the wing. This required special dollies, dies, gauges, etc., the details of which were worked out by Mr. M. M. Morrison of the Calumet and Hecla Mining Co. No. 5 Leyner sharpeners are used exclusively on this work.

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COAL PRODUCTION OF NOVA SCOTIA AND THE EFFECT OF RECRUITING

By F. W. Gray

The second report of the Departmental Committee appointed to enquire into the effect of recruiting on coal production in Great Britain gives the percentage of mine workers who have enlisted since the beginning of the war at 22.5 per cent. of the total mine employees. Rather curiously this figure is practically identical with the percentage of enlistment among the mine workers of Nova Scotia, and in several other particulars events seem to be following the same course in Nova Scotia that they have taken in the coal-mining districts of Great Britain. In the British coalfields the production of coal was so seriously diminished as to create alarm, and in the spring of 1915 a Committee of Enquiry was appointed. As a result of the recommendations of this Committee it was decided that certain classes of colliery workers should be classed as munition workers, or as "starred" men, and for some time past all enlistments from among these specified classes (which include all underground workers) must have the approval of Special Enlistment Tribunal. The composition of this Tribunal is such as to render it free from all suspicion of undue influence from either master or workmen. A similar tribunal, with rather wider powers, decides whether French miners shall remain at home to work for the country in the mine, or shall go to the trenches. Both in France and in Britain it has been recognized that there is a point beyond which the diminution of coal production cannot drop without serious impairment of the military power of the nation, and it seems that the time has come to enquire whether this point has not been reached in Canada. The matter is too grave to be dealt with by those intimately interested in the production of coal, it is not a matter for coal-master or for colliery worker, it is a matter for the leaders of the nation, for governmental enquiry and action.

The time is rapidly approaching, has almost arrived in fact, when the shortage of coal will begin to limit the manufacture of munitions and industrial activity in Eastern Canada.

A very serious situation may be predicted for Montreal and the St. Lawrence towns generally next summer, if the coal outputs continue to decline as they have done during the past four months. Two factors will militate against taking coal to Montreal next summer. First, the shortage and fabulous rates of hire of freighting steamers, and second, the drop in the actual production of coal. The first named factor will operate equally against American coal coming by the Great Lakes route, and the second factor may also apply to United States coal as well as to Nova Scotian coal, if the threatened labor troubles occur around the first of April. In all probability, however, there will not be any strike of the coal-miners in the United States, as our friends across the border may be trusted to compose their differences while business remains so good as it is to-day, and while the demand for munitions and the shortage of labor in the United States coal fields causes a continuance of the present brisk demand for coal.

It must be admitted, however, that a shortage of coal from the Nova Scotia collieries can be partially, if not wholly, filled from the United States, but, apart

from the obvious injustice to the Nova Scotian coal companies and the permanent injury which may result to their business and the future welfare of the colliery workmen of Nova Scotia, it may well be questioned, from a national standpoint, whether it is a good thing to become too entirely dependent upon the United States for our coal supply.

It is not generally realized how long established an industry the mining of coal is in Nova Scotia. Cape Breton coal was sold in Boston and New York long before the development of the vast coal fields of Pennsylvania, Ohio, and Illinois, and before anthracite coal came into general use in the New England States.

It is an instructive commentary on present-day events that the English shareholders of the General Mining Association—the pioneer of coal-mining in North America—were from the first imbued with the idea of establishing a profitable trade in coal between Cape Breton and the New England States. Mr. Richard Brown, the general manager of the Association, writing in 1871, remarks: "It must, undoubtedly, have been a great disappointment to the General Mining Association to find in 1857 that, after a struggle of thirty years, in which neither trouble nor expense was spared, the sale of Cape Breton coal had made such little progress in the United States."

Reluctantly, these forerunners of our own spacious days came to the conclusion—again quoting Mr. Brown—that the General Mining Association "must look chiefly to the British provinces for a market for their Sydney coal, where its character is well-known and appreciated, and that they will find it to their interest to foster the trade by selling at low prices to regular customers, thereby securing a fair profit on their outlay, perfectly free from the fluctuations, and consequent losses, attendant upon a foreign trade, liable at any moment to be suspended by a hostile tariff."

In these far-sighted words Mr. Brown outlined the policy which has enabled the coal mines of Nova Scotia to increase the sales of coal from 294,000 tons in 1857 to 6,500,000 tons in 1913. Since the time that this shrewd forecast was written what a change has come about! The coal production of the United States in 1857 was 13,340,000 tons, to-day it nears 600,000,000 tons annually, and the coal resources of the Republic prove to be vaster the more they are prospected. In 1857 the coal production of Canada was not more than 300,000 tons; to-day it is under 15,000,000 tons annually, and in comparison with the coal deposits of the United States, the Dominion is but meagrely supplied with this great fundamental asset of national supremacy. To-day, Canada imports as much coal as she mines herself, and, if our own production declines, in proportion to that declension we become dependent upon the United States.

The relations of the United States to Canada during one hundred years past, and at the present time—Representative Mann to the contrary notwithstanding—are such as to preclude any serious danger of warfare between the sister nations, allied as they are by language and ideals, by common origin and mutual regard, but nevertheless the independence of any

people is ultimately based on its power to support itself by internal resources. Dependence upon another nation inevitably leads to national weakness, particularly is such dependence by a small nation upon a larger and more powerful one. This is being daily exemplified by the progress of the war.

Coal is the basic munition of war, ranking next to men as a prime necessity of armed force. If political lines of demarcation were a negligible factor, a glance at the map of North America would show that the natural sources of coal supply for the central provinces of Quebec, Ontario and Manitoba, is from the States of Indiana, Ohio, Pennsylvania, and Virginia, and, conversely, that the New England States could be most economically supplied with coal from Nova Scotia.

Yet for better or for worse, we believe for better, the line of demarcation exists, and, from the Canadian point of view, coal that comes from the United States is an import, and a commodity that under certain rather improbable, but not altogether inconceivable circumstances, might be placed under an embargo.

When we see the unnatural groupings of nations that the hostilities in Europe have brought about, and the manner in which unwilling combatants have been forced by almost incredible circumstances to wage war by force of arms or by economic pressure upon former allies and comrades in arms, nothing can be taken for granted, and it becomes increasingly evident that nations which desire to persist can rely only upon their strength in arms and the natural resources within their frontiers.

The United States supplies Canada with some fifteen million tons of coal annually, and certain sections of the Dominion are absolutely dependent upon the United States for a coal supply. If for any reason this source of supply were cut off, all industry in these sections would be immediately paralyzed, and would so remain until arrangements could be made to bring coal from Nova Scotia and the Prairie fields. It is a singular, and might almost be considered an unfortunate circumstance, that the most thriving and populous areas of Canada should be devoid of coal-seams, but such is the case.

The vexed and interminable argument between free-trade and protection does not enter into these considerations, and they are simply put forward to emphasize the paramount importance that, under certain conditions, the all too meagre coal-fields of Canada might possess, and the importance of keeping the machinery of coal production from breaking down at this critical period of our national adolescence. Coal, as Lloyd George has truly said, is to-day the paramount lord of industry—and he might have added, with equal truth—of war also. The nation that possesses coal fields is rich, while the nation that has none is poor indeed; and, moreover, if the coal fields we have are not producing, we might as well be without.

The miner is one of the first of men to volunteer. He is a man habituated to danger, a man who daily takes his life in his hand. To a large extent he is always the guardian of his own life, and must ever be on the watch for danger that presents itself in many different shapes. The miner pits his senses and his mother wit against the elemental forces of nature, against falling roof, explosive and poisonous gases, the gigantic forces penned up in modern explosives, the darkness of the underground; against the fabled elements of water, air and fire. So he is ready at the

call to face the similar dangers of the falling trench, of modern high explosives, of poison gases devised by Teutonic "Kultur," that have Nature's compounds "beaten to a frazzle;" to face with equanimity the eerie darkness of sentry go and listening post before a vigilant and ruthless enemy. None of these things moves him, and it is a perfectly natural thing to those who know the miner to expect that he would answer the call with greater readiness than other men. And such has been the case.

The miners of Nova Scotia have enlisted in far greater proportion than the remainder of the population. The rural districts of the Province have not given men in anything like the percentage of men of military age that the miners have given. Home-keeping youths, it is said, have ever homely wits, and it seems as though the young men residing in the remoter agricultural and fishing districts of the country have not yet realized the gravity of the present emergency. This is partly because it has not been put before them. The recruiting activities of the Government have been concentrated on the industrial centres where men are most easily to be had, and in this respect the line of least resistance has been taken. It is true that to some extent the country districts have been drawn upon to provide men for the industrial centres, but there still remains a large number of suitable men in the country districts whose imaginations have been untouched by the call of their Country, who from ignorance of the danger remain detached and aloof from the spirit of the times.

Canada has promised 500,000 men to the defence of British ideals and democracy, and all but the faint-hearted believe that what she has promised will be given, but there is a danger that we may blunder into the same quagmire that frustrated our hopes in the summer of 1915, when it was discovered that men in the field were helpless without munitions. One of the advantages of the conscript army is that the General Staff can place men in the place where they will be most useful to the nation, and one of the disadvantages of the voluntary system is that it does not allow the exercise of the full efficiency of the nation viewed from the staff point of view. The Derby scheme in Great Britain was an attempt to reconcile the voluntary system with the efficiency of the conscript system, hence the "starring" of munition workers, and the placing of unmarried and young men before the married and older men.

No sane man would wish to discourage recruiting or to do anything that would hinder for a single moment the coming of the final victory that we all so ardently desire. And it is with the desire that the efforts of Canada shall be directed with single aim and the greatest possible effect towards the extirpation of the Prussian menace that these considerations are put forward. As previously pointed out, it is not a matter for master or for man, but it is a matter for the careful consideration of the leaders of the nation. There are reasons, on which it is not well to be too explicit, why we should not become entirely dependent upon United States coal. The choice, as the writer has previously ventured to maintain, is resolving itself into one between men and munitions. Having said so much, and having dared the onus of being regarded as one who discourages recruiting, the writer feels that he has discharged his responsibility in presenting truthfully and faithfully the danger that threatens the production of coal in Nova Scotia, and the incalculable train of circumstances that inevitably follows thereon.

THE PORCUPINE GOLD AREA*

By A. G. Burrows.

The Porcupine gold area, which for the past six years has held the attention of the mining public, is situated on the Hudson Bay slope of northern Ontario. The latitude of Niven's First Base Line of 1899, which forms the south boundary of Tisdale and Whitney townships, is 48 deg. 27 min. 54 sec.; consequently the area is somewhat farther north than the Canada-United States boundary in Manitoba and other western provinces. The camp is in the Timiskaming judicial district. Lying along the southern fringe of the great clay belt of northern Ontario, it adjoins a prospective farming country. In this belt many townships have been laid out in six or nine-mile squares and subdivided into concessions and lots; in the gold area itself and in the adjoining country to the north, many half lots containing 160 acres each have been granted to veterans as homesteads.

Since the second report on this area published by the Ontario Bureau of Mines was written there has been practically no extension of the gold-bearing area. At various times there has been considerable activity in some of the outlying regions, but up to the present no finds have been made that compare with those of Tisdale township. Outlying areas which have attracted attention in the past two years are those situated in McArthur, Turnbull and Robb townships.

It is remarkable that the earliest discoveries at Porcupine have been developed into the largest producers. The outstanding mine is the Hollinger, named after its discoverer, Benjamin Hollinger. The discoveries on Pearl Lake by Alexander McIntyre developed into the McIntyre mine, and that of John Wilson in the south-east part of Tisdale into the Dome mine. The large producing mines are all confined to Tisdale township, and the majority of these are in the vicinity of Pearl lake.

The principal towns of the area are Timmins, South Porcupine and Schumacher. The other townsites which have been established in what was thought favorable locations have not been successful. The town of Timmins is most progressive, and is growing rapidly. The town is situated on a sand and gravel ridge overlooking the Mattagami valley, at an elevation of about 110 feet above the river.

To the north-west and west of Timmins a number of farms are being cleared along the Mattagami river. It is desirable to have a great part of the townships immediately north of the Porcupine gold area, which are in the clay belt, settled, as the farmers will have a near-at-hand market for their produce.

A branch line of railway connects the Porcupine camp with the main line of the Timiskaming and Northern Ontario railway. The line from Porquiss junction to Timmins is 33½ miles in length, and the distance from Timmins to Toronto is 485 miles. When through trains are running the journey requires about 20 hours.

The First Prospecting.

In 1906 some work was done by prospectors on a vein near Miller lake and a few hundred feet from the present Hollinger veins. Evidently, seeing no gold, and having no assays made, they abandoned the property. In the same year claims were staked in Shaw

township on what is described in the application as a "vein of sugar quartz and hematite iron." This is of interest since the so-called vein is simply the upturned edges of the Keewatin iron-formation.

In 1908 claims were staked by H. F. Hunter on the east shore of Porcupine lake. Gold was found sprinkled through the quartz and schist in a sheared zone.

It was not, however, until the following year that the spectacular discoveries of J. S. Wilson, on what is now the Dome property, caused a rush to the district, and in a few weeks practically all of Tisdale and a great part of adjoining townships and unsurveyed territory were staked.

Much work was performed during 1910 and 1911 in the townships near Porcupine lake, and while gold was discovered in a great number of places, it was not shown in the great majority of cases to be in sufficient quantities to warrant the erection of reduction plants. In the succeeding years there has been very little activity in the outlying parts of the area, but the success attending operations at the producing properties in Tisdale township may lead to further exploration. Such prospecting should be carried on with the object of finding large low-grade deposits rather than confining attention to the narrow high-grade veins, several of which have already been found in this area and have not been worked with success.

Since the discovery of gold in this area there have been repeated forest fires which have destroyed much timber. The worst fires in recent years occurred in 1911. About the middle of May of that year a fire completely destroyed the surface plant and buildings of the Hollinger mine.

The greatest fire of the year occurred on July 11th, when, after a prolonged dry season, a hurricane from the south-west brought up a fire. The surface workings and buildings of the Dome, West Dome, Vipond, Standard, Preston, East Dome, North Dome and several other properties were entirely destroyed by fire. The town of South Porcupine was completely wiped out, and almost all the part of Pottsville which escaped the fire of July 2nd. The north part of Porcupine (Golden City) was also destroyed. This fire was attended by a great loss of human life, 71 in all having lost their lives either by being burned, suffocated or drowned. The destruction of the surface plants by this fire retarded the production of the camp for almost a year.

In the parts which have escaped the fires there is a dense growth of timber, including white and black spruce, jack-pine, birch and poplar. It is interesting to note that a growth of young tamarac is replacing the old tamarac trees, which have all been destroyed in recent years by the large saw-fly. An occasional charred stump among the green timber, when gold was first found, showed that most of the forest is of second growth, the area having been ravaged by fires years ago.

Early Examination of Region.

Previous to 1909, the area was little known. There were practically no reports upon it except from explor-

*Extracts from the third report by A. G. Burrows, published by the Ontario Bureau of Mines.

ers and geologists who were attached to survey parties sent out by the Ontario Department of Lands, Forests and Mines.

The main part of the camp is situated along an old portage route, from the Mattagami river to Night Hawk lake, which had been used by the Hudson's Bay Company officials for a couple of centuries.

In 1896 E. M. Burwash examined the country along what was then the Algoma-Nipissing boundary line which was run as far as the south-east corner of Whitney township in that year. He noted the occurrence of quartz veins, carrying traces of gold, at various points on the line. One of these veins he found on what is now the east boundary of Shaw, and only a few miles south-east of the main area. He remarked that the country was a promising one for the prospector but for the drift.

In 1899 W. A. Parks reported on the geology of the portage route from the Mattagami river to Night Hawk lake by way of Porcupine lake. He, like Burwash, noted the occurrence of gold in some quartz veins, particularly in the south-west portion of Whitney township, obtaining assays from a trace to \$1.00 per ton. In his summary Mr. Parks remarked: "I regard the region south of the trail to Porcupine lake as giving promise of reward to the prospector."

Geological descriptions of areas, including and adjacent to the Porcupine area, are to be found in the reports of the Bureau of Mines for 1903, 1904 and 1905 by Messrs. Kay, McMillan and Kerr, respectively.

In October, 1909, Jas. Bartlett made a brief examination, for the Bureau of Mines, of the early discoveries of the area.

All the gold deposits at Porcupine are believed to belong to the same period of ore deposition. They occur in rocks of Keewatin, Timiskaming, pre-Algoman and Algoman age while the mineralization was probably in Algoman times. Some writers on this area have attempted to make a classification based on structural resemblance in certain of the deposits. It may be said that each deposit has peculiarities of its own, but that in general there are characteristics common to all. For example, all the deposits will in parts show such structures as simple vein, lode, irregular masses of quartz, and mineralized schist. These structures are largely dependent on the character of the enclosing rock, whether schistose, greatly foliated, or massive. Some deposits have been formed near the contact of the quartz-porphyry with other rocks, but this feature is not sufficient in itself to warrant such deposits along contacts being classified separately. For example, at the Dome mine the deposit exposed in the large open pit is considerably north of the contact and in the conglomerate and slate, whereas a deposit underground to the south of No. 2 shaft and only a few hundred feet away has the quartz-porphyry as the hanging wall.

While a certain amount of fissuring was present at the beginning of the ore deposition, it is believed that the deposits formed at that time were enlarged by metasomatic replacement. Evidence of replacement of the wall rock can be seen at many of the mines and is particularly well shown at the Dome Lake mine.

The irregular fissuring has produced a great variety of quartz structures, varying from the tabular, though often irregular or lenticular, vein which may be traced several hundred feet, to mere veinlets, often only a fraction of an inch in width and a few feet in length, which ramify through a rock that has been subjected

to small irregular fissuring. This latter variety is well illustrated in the fissuring of ankerite bands, so characteristic of some of the gold deposits of Porcupine. Irregular and lenticular bodies of quartz often occur which may have a width of ten or twenty feet, but which die away in a distance of fifty feet. Again, there are dome-like masses of quartz which are elliptical or oval in surface outline. In some parts at least these masses can be seen in contact with underlying rocks at a low angle, which would suggest that they are broad lenticular masses which have filled lateral fissures in the country rock. The most conspicuous dome masses were those of the Dome property, where the two largest were about 125 feet by 100 feet. A fissure may be vertical and irregular at some points. At others it may incline at a lower angle to the horizontal or take on a more or less lenticular form.

The term "vein" as used in this report is not confined to the filling of a single fissure with well-defined walls, for this type of vein is rather the exception in the Porcupine area. The fissuring has been so irregular that a "vein" in one part may consist largely of quartz, and in another part of numerous veinlets of quartz and intervening schist, greatly resembling a stockwork; again, the main part of a vein may be almost vertical in attitude, but many veinlets, as branches from the main vein, may extend laterally into the country rock. It is often found that the values are obtained in parts of the vertical vein which have been subjected to a later movement and enrichment, whereas the lateral veins have little or no value. This is illustrated in the No. 1 vein at the Rea mine.

The relationship of the strike of the veins to that of the enclosing rock is often difficult to determine, since generally along the veins there has been shearing of the country rock which may conform to the general direction of the strike of the veins. However, by determining numerous strikes in the schist away from the veins, it is seen that the majority of them are inclined to the strike of the enclosing rocks. In dip the veins vary from vertical to nearly horizontal. In No. 1 shaft of the Hollinger the vein is practically vertical, while a series of narrow quartz veins, 6 to 18 inches wide on the Lindburg claim, have a dip at the surface of only 20 degrees. The prevailing dip of the schist in the Porcupine area is to the north at a high angle, and frequently the veins dip distinctly to the south across the cleavage of the schist. While it is apparent that most of the deformation of the country antedates the vein formation, nevertheless there is a decided tendency in many cases for the fissuring to be influenced by the direction of schistosity, which is also a direction of weakness; hence we find veins having a more or less lenticular structure, the strike of which closely corresponds to that of the country rock.

It will generally be found that where the lenses are broad the schistose wall rock is approximately parallel with the lens; whereas the narrow portions of vein between lenses frequently cut across the schist.

Lenticular veins occur chiefly where the country rocks have been intensely sheared or rendered schistose, as around Pearl Lake. Usually when there has been less disturbance the veins are more likely to have a marked difference in strike from the enclosing rock—as around Three Nations lake and the porphyry area south of Simpson lake. It may be stated that the larger and usually lenticular veins of the area occur where the rocks are extremely schistose, while the narrower, better defined veins occur as stringers from these main lenticular veins, or in less disturbed areas.

The quartz-porphry on the Preston, Fogg (L.O. 325) and other claims in Deloro township along its north boundary is more massive than that near the Dome or around Pearl lake, while the greenstone is also much less altered to schist than in other parts. Consequently the veins are narrower and have not the lenticular structure so characteristic of those deposits at Poreupine which are in schistose rocks. Most of these veins have a strike nearly north and south across the mass of quartz-porphry. They lack the banded structure so frequently seen in the Pearl Lake area. Coarse gold associated with zincblende and pyrite occurs in some of the narrow veins, many of which are only a few inches in width. Owing to the narrowness of these rich veins, and the massive character of the porphyry rock which shows little impregnation with gold-bearing solutions, difficulty has been experienced in finding ore bodies of commercial importance.

Distribution of Veins.

While gold-bearing veins occur over a wide area and are often isolated, it is seen, from a number of those already discovered, that they occur in groups along certain lines. For instance, in Tisdale township there are at least three distinct areas where the fissuring has been most pronounced. One such area extends from the south-east end of Miller lake, on lot 11, in the second concession, in a north-easterly direction for three miles, and includes such veins as the Poreupine Crown, Millerton, Hollinger, Aeme, McIntyre, Jupiter, Rea, and in addition others with visible gold. The average strike of the veins here is north-east and south-west. An exception is a vein on the Poreupine Crown, which strikes north and south.

Another series, including the Smith, Davidson, Crown Chartered and Dobie, occurs in the north-east part of the township. To these should be added the Scottish Ontario, Mullholland, Hughes and Gold Reef, which are in the north-west part of Whitney township. The general direction of these veins is east and west.

Again, in the south-east part of the township is a group including the Dome Lake, West Dome, Dome, and Dome Extension, with a general strike north of east.

Occurrence of the Gold.

A field examination shows that there is an irregular distribution of the gold in the quartz veins. Very often it occurs along dark streaks in the quartz, along the contacts of quartz and schist, or around patches of dark colored mineral in the quartz. At the surface, rich portions of veins are often indicated by rusty streaks or patches, while at depth the rusty character gives place to dark grey, black or greenish colors.

Under the microscope the gold is generally found in areas which have been greatly crushed or in the quartz or schist bordering on these areas.

The prominent minerals which occur in the crushed areas are pyrite, calcite, dolomite, sericite, chlorite, tourmaline and quartz. It is thought that most of the gold has been deposited along with pyrite from the impure solutions which circulated in the minute fissures and crushed areas of the primary quartz of the veins. The quartz of No. 1 vein of the Hollinger mine shows numerous dark streaks in parts of it and often across the width of the vein. These are generally short and irregular in distribution. Iron pyrites and often galena occur with the gold. Microscopically, the quartz occurs in fairly large grains, contains liquid and gas inclusions, and has been subjected to secondary pressure and granulation along the margins of the

grains. The iron pyrites often occurs in well-shaped crystals which have been formed subsequent to the crushing. These fine dark streaks may have resulted from a solidification and shrinkage of the quartz forming filmy cracks, which may have become slip or crushing planes along which the richer gold-bearing solutions were deposited at a later period. These minute dark streaks in the quartz are frequently slickensided, and this character may often be seen in hand specimens, as from Rea or Vipond mines.

It should be noted that where cracks or fracture planes have been produced in a quartz vein and subsequently filled by minerals from solution, secondary quartz can be distinguished with difficulty, if at all, from the original quartz. Hence it is not always possible to say whether visible gold in such a vein occurs in the original or in secondary quartz.

Often a vein may show a width of ten feet but the fractured portion may be only a few feet, or even inches, wide along either wall. In this portion there may be many streaks of dark mineral which are often parallel, giving a banded character to the ore, as in many of the veins in the north part of Whitney and Tisdale, namely, at the Mullholland, Scottish Ontario, Davidson and adjoining properties. A similar banded structure is seen at the Rea mine. At these properties tourmaline is the principal mineral of the streaks. The gold may occur along these lines or in the intervening quartz, which is often much crushed and filled with later minerals. Several sections were examined, which showed grains of gold apparently enclosed in the primary quartz, but the occurrence is much less prominent than where gold occurs in the crushed areas.

It is important to note that practically all the veins which are gold-bearing contain considerable carbonate of varied composition. Wherever the enclosing rocks are schistose they always carry carbonate and frequently effervesce with cold hydrochloric acid. Much of the carbonate of the veins has been absorbed from the wall rock, while portions have been formed from ascending solutions which circulated in the veins. Pyrite and grains of gold frequently occur in the carbonate.

Carbonate in the form of ankerite constitutes the main portion of veins at the West Dome, Apex, and in parts of Deloro township. This carbonate is distinctly earlier than the quartz veinlets which intersect the ankerite veins. Both the ankerite and quartz have been fractured and veinlets of later carbonate deposited in them.

Sulphides and other Minerals.

The following sulphides have been recognized in veins at Poreupine: iron pyrites, copper pyrites, pyrrhotite, arsenical pyrites, galena and zincblende. Of these the most abundant is iron pyrites, which occurs in some quantity in all the gold-bearing veins. Copper pyrites, galena and zincblende, although also widely distributed, occur in minor quantity. Pyrrhotite is the chief sulphide in the veins which are being developed in No. 4 shaft of the Dome Extension. Arsenical pyrites occurs in quantity in the quartz veins at the McAuley-Brydges property in Bristol township.

Only one telluride has been recognized, occurring in the quartz-carbonate deposit at the Powell claim, M.E. 20, in Deloro township. A chemical test of the mineral gave the following percentages: silver, 61.88 per cent.; gold, 0.10 per cent., with strong reactions for tellurium, corresponding to the mineral hessite. Native gold

occurs as a later constituent in minute seams in the hessite. Robt. Harvie reported the telluride "petzite" in quartz-ankerite deposits at Opasatika lake in the province of Quebec. The presence of telluride in a quartz ore, containing considerable pyrites, from the Mikado mine, lake of the Woods, has lately been recognized in the laboratory of the Provincial Assay Office.

The rare mineral scheelite has been found in small quantities in several properties around Pearl lake. This is the second occurrence noted of this mineral in Ontario, it having been reported on the dump at the Victoria mines, near Sudbury.

Since the whole surface of the area has been deeply eroded during recent glacial periods, there is now little evidence of secondary enrichment. The enrichment is very superficial, extending only from a few inches to a few feet in depth. The outcrops of the veins and wall rocks are usually discolored or decomposed, due to the oxidation of the iron pyrites and the ferrous carbonate in the ankerite or other iron-bearing carbonates. Cubes of iron pyrites are occasionally obtained at the surface, while copper pyrites and arsenopyrite also occur near the surface. Where the veins have been oxidized to any depth, there are generally some very recent water courses in evidence. Developments so far have shown that, after this very superficial zone has been penetrated, the character of the vein material has remained the same as far as mining operations have continued, namely about 1,000 feet.

WILL ERECT NICKEL REFINERY IN CANADA.

OTTAWA, Feb. 7.—The correspondence in regard to nickel, given below, was laid on the table of the house of commons by Sir Robert Borden to-day.

Ottawa, Dec. 29, 1915.

To Ambrose Monell, President International Nickel Co., New York:

My Dear Sir,—As you are doubtless aware, the question of refining nickel in Canada has engaged public attention in recent years. Since the outbreak of war there has been a particularly strong feeling that, apart altogether from any commercial aspects, there should be established in this Dominion a nickel refinery sufficient at least to supply all the requirements of the British Empire under any conditions and in any emergency.

I trust that the erection of such a refinery will receive careful consideration and active attention of your company. As Canada produces about 85 per cent. of the world's supply, it seems both desirable and necessary that such action should be taken as soon as possible. In making this suggestion I am not unmindful of the difficulties which you have explained to me on more than one occasion, but which I hope the ability and resourcefulness of the company's directors and officers may successfully overcome.

R. L. Borden.

International Nickel Co., 43 Exchange Place, New York, Jan. 7, 1916:

The Right Hon. Sir Robert Borden, Ottawa, Canada:

Dear Sir,—Replying to your letter of December 29th, we beg to state that we understand the high purpose in your expressed desire to have a nickel refinery installed in Canada, and we greatly appreciate the spirit in which you have brought this matter to our attention.

We will grant your request, and erect in the Dominion of Canada, at such point as seems in our judgment to be the most economical for operation, a plant for the refining of nickel of such initial capacity as will secure to Great Britain and Canada within themselves a product of finished nickel to the extent of their requirements.

It will cost more to refine nickel in Canada than at the present point of operation. This disadvantage to us as manufacturers, however, is overshadowed by the imperial necessity you emphasize, that sufficient nickel shall be refined in the Dominion of Canada to enable the British Empire to have under its control sufficient nickel refining capacity to meet its demands.

As soon as the weather permits we will promptly undertake the selection of a suitable site for such operations, which in our opinion will be somewhere on the Canadian Atlantic seaboard.

A. Monell, president
The International Nickel Company.

Ottawa, Ont., Jan. 10, 1916.

To A. Monell, President International Nickel Co., New York:

My Dear Sir,—I beg to acknowledge with thanks your letter of the 7th inst., and I note with a great deal of satisfaction the intention of your company to establish a plant for the refining of nickel in Canada. I trust that the plant will be of such initial capacity as to secure not only to Great Britain and Canada, but to the whole empire, a product of refined nickel to the extent of all possible requirements.

R. L. Borden.

The International Nickel Co., New York, Jan. 27, 1916.
Sir Robert Borden, Ottawa, Canada:

Dear Sir,—We beg to acknowledge receipt of your letter in regard to our proposed plant for the refining of nickel in Canada.

As the consumption of nickel in the British Empire outside of that consumed in Great Britain and Canada is insignificant in amount, an initial plant capacity to secure to Great Britain and Canada within themselves a product of nickel to the extent of their known requirements will meet your expressed desires.

The refinery will be designed in units, so that even further units can be added as the future requirements may determine.

W. A. Bostwick,
Assistant to the President.

CONIAGAS.

Cobalt, Feb. 5.—The remainder of the machinery required for the new Cyanide mill at the Coniagas was received yesterday. Delays in securing transportation on account of the war, has held back the completion of the mill by about six weeks or more, but now that everything is in hand there is only the piping to be connected before the plant is put in operation.

WRIGHT CLAIMS.

Cobalt, Feb. 5.—It is understood that the Cartwright interests have purchased the Wright claim which adjoins the Adanac, and that the first payment has been made. On the Wright claim some surface work has been done on a 6-inch calcite vein and several other smaller veins exposed by trenching. On the six-inch vein a fifty-foot shaft has been sunk.

RENOLD CHAIN DRIVES FOR BLOWERS

We have received from Jones & Glassco an illustrated pamphlet briefly describing a very interesting and important application of Renold Chain Drives. These drives solved a difficult transmission problem in a very large Canadian plant. The company in question had three Roots blowers (two single and one double



One of two 150-H.P. Renold Chain Drives operating double-ended Blower.

ended) and wished to re-arrange them to provide space to install a fourth. The blowers were driven from individual electric motors by leather belts and were already arranged to occupy the minimum space consistent with the efficiency of this form of transmission. Obviously more compact drives were required, but satisfaction also depended on the drives being efficient and flexible. Direct connection, with existing motors was out of the question, while the impulsive nature of the load made gears quite unsuitable.



300-H.P. Renold Chain driving a No. 9½ Roots Blower (showing top half of gearcase removed.)

The difficulties were overcome by the Renold Silent Chains which are here illustrated.

In the case of the 150 H.P. Drive illustrated the following data clearly show the great saving of space obtained by the use of the Renold Chain.

	Original Belt Drive.	Renold Chain Drive
Centres.....	25' 0"	6' 6"
Pulley or Wheel diam.....	12"	9½"
Wheel diam.....	57"	44½"
Width.....	24"	12"



200-H.P. Renold Chain Drive (top half of gearcase removed).

Proportionate savings of space were obtained in the case of all the Drives. It should be noted also that owing to the efficiency of the chain drive being 98.2% the power required to drive the blowers is reduced to the minimum.

When it is considered that a mishap to these blowers, which we believe are the largest of their kind in Canada, means a shutdown of practically the entire plant, the installation of these chains by this Canadian company is the strongest evidence of the reliability of the Renold Drive.

The company's engineers reported after these Drives had been running 21 months continuously night and day: "Drives running well and giving every satisfaction."

OPHIR.

Cobalt, February 2.

Diamond drilling is now well under way at the Ophir property. The work is being done from the lowest level, and the object is primarily to ascertain the distance down to the contact. It is the intention to continue the present shaft down to the contact, and it is necessary that the distance should be known before ordering the new hoist. It is expected that the diamond drilling operations should be completed within a week or ten days.

LA ROSE.

Toronto, February 11.

According to Kiely, Smith & Amos, the La Rose Co., of Cobalt, has taken over the Maiden MacDonald claims in the Township of Deloro. A gang of men has started building mining camps and getting ready to diamond drill and sink test pits on the showings.

TRIUMPH.

Tenders have been called by the Triumph Mines Company at Porcupine for the sinking of an incline shaft on the company's claims near Schumacher.

THE SLOCAN DISTRICT, BRITISH COLUMBIA, IN 1915

By E. Jacobs.

The Slocan district of British Columbia comprises two mining divisions, namely, Slocan and Slocan City divisions. Within the boundaries of the former are situated all the larger producing mines of recent years; the latter is in what is known as the "dry ore belt," the ores occurring in it generally containing high value in silver but not much lead, with gold in some ores assaying from \$1 to \$7 a ton.

Slocan Mining Division.

Ore production in 1915 was, on the whole, on a similar scale in Slocan division to what it was in 1914, that is as regards silver-lead ore. The total of silver-lead ore and concentrate received in 1914 at the Consolidated Mining and Smelting Co.'s smelter at Trail from mines in the Slocan division was 14,352 tons; in 1915 the total was 13,047 tons, but in addition there was 1,500 or 1,600 tons shipped to the United States from the Surprise mine which up to October 28th had milled approximately 9,000 tons of ore and had shipped 1,415 tons of silver-lead ore and concentrate and 2,660 tons of zinc concentrate. Taking into account the lead-zinc ore milled as well as the silver-lead ore, there is little doubt that later returns will show that there was a considerably larger quantity of ore mined in Slocan division in 1915 than in 1914.

Several of the mines that produced ore in 1914 were not on the 1915 list, notably the Richmond-Eureka and the Van-Roi, and the much smaller shippers Antoine, Cinderella, Colonial, Evening, Freddie Lee, Lone Bachelor, and Noonday. Against these, however, may be placed others that in 1915 were added to the shipping list, namely, the Galena Farm, Idaho-Alamo, Mountain Con, Reco, Wakefield, and several smaller shippers, including the Buffalo, Mercury, Molly Hughes, and Rio.

The mines from which more than 100 tons of ore each was received at Trail in 1915 were as under:

	Tons
Hewitt-Lorna Doone	641
Idaho-Alamo	115
Lucky Thought	101
Mountain Con	129
Rambler-Cariboo	2,160
Ruth-Hope	553
Slocan Star	986
Standard	7,936
Wonderful	199
Sundry small shippers	227

Total, Slocan division, receipts at Trail. 13,047

The smaller shippers were as follows: Black Grouse 11 tons; Buffalo 14 tons; Galena Farm 29 tons; Home Rule 2 tons; Ivanhoe 18 tons; Mercury 17 tons; Molly Hughes 18 tons; Reco 73 tons; Rio 13 tons; and Wakefield 32 tons.

Bear Lake to Sandon.—Work was resumed at the **Lucky Jim**, after a conditional settlement of financial troubles. There is much zinc ore developed in the mine. Arrangements were made for concentration of ore at the Ivanhoe mill, Sandon, but three days after milling of the ore was commenced the mill was destroyed by fire. Several weeks later Mr. J. P. Keane, who had been operating the Ivanhoe mill as a custom plant, arranged to use the zinc-concentrating plant near Rosebery, Slocan Lake, and before the end of October Lucky Jim ore was being concentrated there.

The **Rambler-Cariboo** shipped 2,160 tons of silver-lead ore and concentrate to Trail in 1915, against 1,934 tons in 1914. In addition, zinc concentrate was sent to the United States to a reported total quantity of 934 tons. An application by mail to the president of the company, a Spokane business man, for some information relative to the year's operations and results did not meet with even the ordinary courtesy of acknowledgment, so, as the officials at mine and mill were not free to give particulars, none were obtained. The Rio, above the Rambler-Cariboo, was further developed by lessees, who mined and shipped a few tons of ore. Late in the year development work on the Soho group in the same neighborhood, was arranged for.

About Sandon and Cody.—Development of the deep of the Payne mine was continued; the raise from the 1,500-ft. level, which is a crosscut adit driven about 3,600 ft. into the mountain, to the old 800-ft. level was completed and an intermediate level opened from the raise to cut ore followed down 34 ft. in a winze from the 800-ft. level, which object was achieved.

The Ruth Mines, Ltd., operating the Ruth and Hope groups of claims, near Sandon, continued driving a lower crosscut adit (No. 5) commenced in August, 1914, extending it to about 1,700 ft. from the portal. Some 400 ft. of drifting was done and for half that distance there was a small shoot of ore, sometimes clean and at others mixed ore. It was expected that a raise 450 ft. to No. 4 level would be completed by the end of the year. The company's concentrating mill at Sandon was remodelled, an aerial tramway was constructed from the portal of No. 5 to the mill, and in the autumn ore-concentration was resumed after a long period of inactivity at the mill. The Ruth silver-lead concentrate averages 135 oz. silver a ton and 60 per cent. lead; the zinc product contains 120 oz. silver a ton and 37 per cent. zinc.

The position at the **Slocan Star** mine, as indicated by the company's published reports, is substantially better than at the end of 1914. During the calendar year 1915 there was received at Trail from this mine 986 tons of silver-lead ore and concentrate; besides this there was some zinc concentrate shipped to the United States. Production in 1914 up to the time of suspension of operations in August on account of the war, comprised 868 tons of lead ore and concentrate shipped to Trail, and 664 tons of zinc concentrate. The grade of ore and concentrate is shown in the following excerpts from the annual report for the fiscal year ended October 31, 1915: "Shipments of crude ore from development for the year were: Lead ore, 204 dry tons assaying 83.94 oz. silver to the ton, 59.86 per cent. lead, and 6.94 per cent. zinc, and 43.40 dry tons zinc ore, assaying 12,015 oz. silver to the ton, and 43.65 per cent. zinc." . . . "The mill ran 251 shifts of 11 hours and milled 17,837 tons of dry ore, an average of 71 tons a shift, producing 665.5 tons of lead concentrate averaging 66.55 oz. silver a ton, 58.33 per cent. lead, and 8.15 per cent. zinc; also 1,400 tons zinc concentrate assaying approximately 15 oz. silver a ton and 32 per cent. zinc. Milling cost averaged 37½ cents a ton of ore milled, and mining and tramping \$1.55 a ton, making a total of \$1.92½ a ton for mining and milling." Included in the superintendent's report was the information that "on No. 2 level there is a strong vein

of zinc blende from which ore containing 45 per cent. zinc can be sorted. On No. 8 level a shoot of ore 60 ft. long has been opened. It is wide and consists of mixed ore, with bunches of clean ore. . . . Stopes 810 and 811 are showing a much better class of concentrating ore as well as considerable crude (shipping) ore. The new ore being opened on No. 9 is the downward continuation of the shoot on No. 8; no doubt it will also be found on No. 10. There is a large quantity of zinc ore in levels Nos. 2, 3, 4 and 5, part of which can be mined at a profit with zinc at its present price." Shareholders in the company have been told that it is estimated by two mining engineers who examined the mine that with zinc at five cents a pound there is in the mine, available for extraction, zinc ore to the value of \$590,000. Since the annual meeting was held in December, the shoot of good ore opened on No. 9 level has been found to continue down to No. 10, which opens for stoping a comparatively large area of virgin ground. Before the end of the year a sale was made of the accumulated zinc concentrate and, too, a three-year contract for the zinc output of the mine was entered into. With the object of increasing the saving of the valuable metal contents of the milling ore and to facilitate operating the mill continuously throughout the year, the directors of the company have authorized the installation of a tube-mill, the construction of another tramway, and the provision of plant for more power.

The management of the **Surprise** mine shipped its lead as well as its zinc product to the United States in 1915. Shipments of lead ore from this mine to Trail in 1914 totalled 516 tons, but not any was sent there in 1915. Returns of shipments made since the end of October have not yet been received, but the output of the mine for ten months was approximately 9,300 tons, of which about 9,000 tons was milled, the remainder having been sorted lead ore shipped crude. The total quantity shipped to October 28 was 1,415 tons of lead product (30 cars of concentrate and 7 cars of crude ore), and 64 cars containing 2,660 tons of zinc concentrate. The estimate for November and December, made at the end of October, was that 1,500 tons more would be shipped, say 1,000 tons of zinc and 500 tons of lead product. Zinc concentrate was shipped to the Empire Zinc Co., Collinsville, Oklahoma, and the lead product to the American Metals Co., Newark, New Jersey. It may be of interest to note that the average metal contents of the ore milled were silver 27.8 oz. to the ton, zinc 19.7 per cent. and lead 8.7 per cent.; the average recovery was of silver 78 per cent., zinc 57 per cent., and lead 92.5 per cent. The ore was concentrated at the Ivanhoe mill, Sandon, until fire destroyed that concentrator; afterward the Rambler-Cariboo mill was used for an agreed part of each month. The owners of the Surprise mine are Congressman Wm. Kent, of Kentfield, Marin Co., California, and Mr. Alex. Smith, of Toronto, Ontario.

The Noble Five group was not among the ore shippers in 1915, but deep-level development was continued under the direction of Mr. Paul Lincoln manager. The crosscut adit, which was in about 900 ft. at the close of 1914, was extended to 2,300 ft. from the portal. At 1,890 ft. in the Noble Five vein was reached; a strong vein, 16 ft. wide, heavily mineralized chiefly with iron. It was drifted on 150 ft. and it still retained its size and character, but was explored too far west to enter the oreshoot opened in the old Noble Five workings 1,200 ft. above. Late in the year the adit was being further extended to cut the

Last Chance vein 2,000 ft. below where it was worked by the Last Chance Co., which some years ago mined much ore from it. In January the crosscut entered the Last Chance vein at 2,700 ft. from the portal of the adit. The adit is 2,500 ft. lower than the apex of the ridge above and east of Cody gulch. It is planned to raise from the adit to workings in which milling ore is known to occur. Among the objects in view in driving this low-level crosscut is to avoid the danger to which employees are every winter exposed in the snowslide season, a number of men having lost their lives when going to or from the upper camp during the long period since the Noble Five was opened; further, when the raise shall be through to the upper workings, it will be practicable to operate the mine throughout the year, and, as well, to handle the ore at lower cost than that which includes keeping in working order the aerial tramway from the upper outlet from the mine down to the mill in the valley below. It is of interest to know that the machine drills used in the crosscut adit mentioned are operated by air compressed at the mill in Cody and delivered through 3,000 ft. of pipe to the portal and thence more than 2,000 ft. to the working face.

The Noonday, situated a mile or so west of Cody, is opened by three adits. No. 1 reached the vein at 75 ft. in; No. 2 at 165 ft., and No. 3 at 290 ft. The vein has been drifted on 350 ft. N.E. and 800 ft. S.W. on No. 2 level, above which there is about 100 ft. of stoping ground. No. 3 is 140 ft. vertically or 160 ft. on dip of vein below No. 2; when visited in October the drift south-west on No. 3 was in 120 ft., with about 100 ft. more to be driven to get under the oreshoot opened in No. 2. A wagon road was constructed last year up to the mine, and buildings have been erected for the accommodation of the men employed.

A vein on the Airdree fraction, next to the Freddie Lee, situated above the Colonial, at a high elevation on the mountain across the gulch from the Noonday, was followed for two or three hundred feet and some high-grade silver-lead ore taken out, but the ore shoot had been small along the drift run up to the end of October. From the Mountain Con, in the mountains to the southward, there was shipped one car of high-grade ore in May and two cars in October. Of the latter, one car of 43 tons averaged 1.022 oz. of silver to the ton and 41 per cent. lead (another statement gave 1.063 oz. silver and 44 per cent. lead), and the other car, of 42 tons, 689 oz. silver to the ton and 20.5 per cent. lead. Six men were working leases on the Reco; four of them on the Reco vein and two on the rich Reco-Goodenough vein. Ore had been taken out and was waiting for snow for rawhiding down to Sandon. The Dunedin was worked through what is known as the No. 4 tunnel of the Reco. Work on the Twilight was chiefly driving a new tunnel to get under a shallow shaft in which, at 20 ft. depth there is a showing of good ore.

Above Sandon, work was continued on the **Wonderful**, the face of the drift being about 350 ft. below the surface, in a nice vein in which galena occurs in irregular bunches. The ore shipped averaged about 90 oz. silver to the ton and 50 per cent. lead. Leasers worked on the Yakima, of the Ivanhoe group, and got out a little ore. Three men worked last summer on the Lone Bachelor.

Three Forks and Alamo.—About two carloads of **antimony** ore was brought down to Three Forks from the Alps-Alturus group, distant 13 miles and situated at the head of a tributary creek of the north fork of

Carpenter creek. One carload was shipped to England and, it was reported lately, the second car was sent to Chicago. No particulars of metal contents were published. A find of dry silver ore on the Black Grouse was made in the autumn and a shipment of 11 tons was made to Trail. McPherson was at work above the Jo Jo, near the McAllister. Over the divide, in the extreme western part of the Ainsworth mining division, is situated the Panama, on which a crosscut cut the vein at 60 ft. in; after drifting for 400 ft. a winze was sunk 40 ft. and a drift run for 60 ft. at that depth. The ore extracted lately averaged about 250 oz. of silver to the ton, while that mined earlier ran only 150 oz., so a general average of 200 oz. is estimated. From a 60-ft. shaft, sunk in the vein, 1,800 sacks of ore, about 63 tons, was taken out earlier. That ore contained a little lead.

Thos. Avison and associates took out from the Idaho about 300 sacks of silver-lead ore and did a little development work in this mine. From the neighboring Alamo mine, they extracted 900 sacks of ore and did some work from No. 3 tunnel, chiefly raising and stopping.

(To be continued)

CANADIAN MINING INSTITUTE.

The eighteenth annual meeting of the Canadian Mining Institute will be held in the City of Ottawa on Wednesday, Thursday, and Friday, March 1st, 2nd and 3rd, 1916. The Institute's headquarters will be the Chateau Laurier Hotel, to the manager of which application should be made for accommodation. The Hotel quotes reduced rates for room accommodation for those attending the meeting. The Eastern Canadian Passenger Association has conceded special transportation privileges to members and their friends attending the meeting, based on the lowest first-class fare for the round trip on certificate plan.

Among others the following papers will be presented for discussion:—

"Flotation Processes," by T. A. Rickard; "Flotation at the Anaconda Mines," by E. P. Mathewson; "The Concentration of Molybdenite as applied to Canadian Ores," by Henry E. Wood; "The Flotation of Bornite," by H. W. DuBois; "Some Effects of the War on the Mining and Metallurgical Industries of Canada," by A. Stansfield; "Canadian Supplies of Iron and Steel in Relation to Munitions of War," by Thos. Cantley; "The Coal Resources of Canada with Special Reference to the Metallurgical Industries," by J. B. Porter; "The Coal Situation in Canada," by W. J. Dick; "The Magnesite Industry in Canada," by Howells Frechette; "Discovery of Phosphate of Lime in the Rocky Mountains," by Frank D. Adams and W. J. Dick; "The Zinc Occurrences at Notre-Dame des Anges, Que.," by J. A. Bancroft; "Canadian Gold and War Finance," by Adam Shortt. This subject will also be discussed by J. Murray Clark, K.C.; "Rock Crushing Tests at McGill University," by J. W. Bell; "Some Conditions Affecting Education in Mining and Metallurgy," by J. C. Gwillim; "Mining Education," by L. D. Burling; "Mineral Deposits of the Buckingham District," by Morley E. Wilson; "Concentration of Ontario Magnetites and the Sintering Thereof," by an official of the Mines Branch of the Department of Mines; "Copper Mining in Alaska," (illustrated with colored lantern slides), by H. W. DuBois; "Petrolia, Past and Present," by J. Stansfield.

The annual dinner will be held at the Chateau Laurier on the evening of Thursday, March the 2nd.

By the courtesy of Dr. J. Bonar, Deputy Master, members will be afforded the opportunity of visiting the Royal Mint. Arrangements have been made for visits, under the guidance of members of the Local Committee, to the Ore-Dressing Laboratory and Fuel Testing Station of the Mines Branch, of the Department of Mines; to the Victoria Museum and to the National Gallery.

PERSONAL AND GENERAL

Mr. A. A. Hassan, who recently opened an office in Washington, D.C., is prospecting gold deposits in Montgomery Co., Maryland. Three diamond drills are now in operation on the properties.

Mr. W. F. Ferrier has returned to Toronto from the West.

Mr. W. E. H. Carter is in Toronto.

Mr. W. A. Bostwick, assistant to the president of the International Nickel Company, was in Sudbury last week.

Dr. W. G. Miller, of the Ontario Nickel Commission, will sail for England this month.

Mr. J. B. Tyrrell sailed for England on February 9.

Mr. B. Babayan is in Toronto.

Mr. A. B. Clabon is in Toronto.

Mr. J. Houston has resigned as manager of the Schumacher mine to accept position as assistant manager at the Dome mine, South Porcupine.

Mr. G. F. Trethewey has been appointed manager of West Dome mine, Porcupine.

Mr. C. E. Foster is in Toronto.

Mr. Frank Loring is in Toronto.

Mr. P. A. Robbins has returned to Timmins after attending a meeting of directors of Hollinger Mines, Ltd., in Toronto.

INTERNATIONAL NICKEL CONTRACT.

New York, Feb. 12.—International Nickel Co. has closed a contract with Great Britain for a very large tonnage of nickel, to be delivered in monthly instalments over one year. This contract is by far the largest single contract ever signed by the Nickel Company. It is understood that it will require over 20 per cent. of the company's production in the course of a year. The contract will crowd capacity of the company's plants to the limit. Effect of the contract will be felt in the current quarter as deliveries will begin very soon.

MORE POWER FOR KIRKLAND LAKE.

During the past few weeks negotiations have been under way for additional power for the Tough-Oakes and other properties north of Cobalt. It is expected that the Northern Ontario Light and Power Company will extend its line to Kirkland Lake. This will solve the power question for many properties and will undoubtedly lead to the early development of many promising prospects along the T. & N. O. Ry.

NEW GEOLOGICAL MAPS.

The Geological Survey, Ottawa, has published recently the following maps: 137A, and 138A, Arisaig, Antigonish Co., Nova Scotia, to accompany a report by M. Y. Williams; and 112A, Vananda, Texada Island, British Columbia, to accompany a memoir by R. G. McConnell.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND SWASTIKA

Porcupine Crown.

Porcupine Mines, Limited, held the annual meeting in Montreal recently and gave a summary of the financial conditions of the property which has already been published in the daily press. The net value of the production for the year 1915 after deducting mint charges was \$613,565. 46,419 tons was milled, of which 41,326 came from the mine and 5,093 tons from the tailings of the first amalgamation mill. 23,964 tons of broken ore is on the timbers in the mine. 4,965 feet of prospecting and development was driven and 2,616 feet of diamond drilling was done. The average value of the heads of mine ore was \$14.46. The average value of tails was .3336 cents; the average extraction was 97.07 per cent. The ore reserves showed a decrease for the year, but the company earned \$240,000,000 in dividends and \$57,873 was added to the surplus, making a net surplus of \$269,977. Ore valued at \$400,000 was blocked out, giving the property ore reserves at the present time amounting to \$1,250,000. At the 700 ft. level there has just been opened up an orebody two feet wide of high grade ore. Previously in this drift the vein had shown but low values. Milling costs were down to \$1.09 cents a ton and entire operating costs were lowered considerably and the percentage of extraction increased. Mr. S. W. Cohen notes that nearly all the ore developed during the year has been south of the main fault. This ore has changed its characteristics. Instead of being one big vein of quartz it now shows stringers of quartz distributed through mineralized schist. The grade per ton has been materially lowered, but the tonnage which can be stoped out at a profit is much higher.

Tough-Oakes.

Much interest has been taken in the proceedings at the annual meeting of the Tough-Oakes Mining Company at Haileybury. It has been known for some time that there would be a test of strength between the Foster and Tough interests and the English interests backed by Mr. Harry Oakes and Dr. Robbins of the Canadian Tough-Oakes Company. There are no less than 280,000 shares of the Canadian Tough-Oakes tied up in law suits in the English courts. The meeting was called to order with Mr. C. A. Foster in the chair. He ruled that according to a by-law of the company which provided that one-third of the issued stock of the company must be represented at the meeting no legal meeting could be held, and he moved that the proceedings be adjourned until such time as the annual meeting could be held legally with sufficient stock represented.

At the meeting there was 143,956 shares represented, whereas there are 531,500 shares issued, therefore one-third necessary to give a quorum was 177,166 shares. It was upon this fact that Mr. Foster and his supporters take their stand that the meeting was not legal. Mr. Harry Oakes and his supporters did not accept this view of the situation. They held that the by-law called for one-third of the issued stock which it was possible could be represented at the meeting. If this interpretation were put on the by-law they had sufficient stock to hold a legal meeting. They therefore proceeded to hold a meeting and elect officers. Mr. Harry Oakes was elected president, Dr. R. J. Robbins vice-president, and Messrs. J. W. Morrison, W. H.

Wright, J. B. Holden, Albert Burt and J. Y. Murdoch directors. Upon this directorate there are represented both the Tough interests and the English interests of which Mr. Latilla is head. At the present time of writing there is a deadlock. Mr. Harry Oakes as president of the new company gave notice to the bank that cheques for the Canadian Tough-Oakes Co. could only be issued under his name and that of Dr. Robbins. The bank, under instructions of Mr. Foster and his supporters, could not accept this interpretation. A deadlock is thus involved.

Dome.

The eight foot, thirty inch ball mill which has been installed at the Dome is doing remarkable work. It is receiving preferential feed, the ore to it having to pass through a two and a half inch ring. Under these circumstances it is treating between 420 and 450 tons a day, and the great increase in production last month at the Dome was largely due to this fact. In the official announcement of the Dome some results at the 700 ft. level were made known. These are sufficiently startling. A crosscut runs through 27 ft. of ore averaging \$9.60, while the extension of this crosscut showed 58 ft. of \$4.30 ore. A drift going south on the same level is now in \$12 ore, how much the official report does not yet say. The bullion production for January was \$176,590. This was the largest production of bullion in any one month and compares with \$160,050 in December, which was the largest production previously. The tonnage milled amounted to 31,600 and the average value per ton was \$5.58. 1,480 tons more was treated than in any previous month, and production was greater by \$15,640.

Davidson.

The five Davidson claims in Northern Tisdale are under option to Mr. R. H. Lyman until April 1st. It is understood that Mr. Lyman is acting for a New York syndicate. These claims include the Davidson, upon which the Crown Chartered did all the development in the last year they were working. The Crown Chartered has now nothing to do with these claims, but they are still in the liquidator's hands and the company taking them up must wipe out all debts. Before closing down, the Crown Chartered developed a body of mill ore on two levels on the Davidson. The mine was closed down before any definite figures could be obtained.

Porcupine Vipond.

At the 400 ft. level of the Porcupine Vipond there has now been cut one of the best orebodies yet discovered on that property. A crosscut was driven from the bottom of the winze to the shoot on the 400 ft. level. After cross-cutting for 60 ft., a few holes were driven into the side of the crosscut. The first few shots found ore and there is now developed about 10 ft. of ore which will run \$14.40 to the ton. Both in width of orebody and grade of ore it is far better than the average for the mine. Within the last three or four months profits on the Vipond have been smaller since the grade of ore showed a decrease, and the costs remained about stationary. If this new orebody develops as it is hoped it should be possible for the Vipond to raise its production to the level it attained in the summer of 1915.

Dome Lake.

In raising from the 300 ft. level to the 180 ft. level the Dome Lake has run into good ore. There was

good ore in the winze sunk for some distance below the 180 ft. level. It was then determined to run a raise from the 300 ft. level to the 180 directly in the ore shoot. For 31 ft. there was no ore. The management then decided to put some shots in the walls and a good body of ore is now being opened up. It is 6 or 7 ft. wide of eight or nine dollar ore and shows a considerable amount of free gold. It is now believed that the ore at the 180 ft. level was cut off by a slip, and that it will be possible to follow and develop it down to the 300 ft. level.

Kitchigami.

A Lake Superior company called the Kitchigami Gold Prospecting Company is diamond drilling the western group of Gordon claims at Goodfish lake. The object of this work is to pick up the extension of the Costello vein system. Mr. F. C. Botsford is in direct charge of the work. The company was organized under the Arizona State law, with a capital of \$300,000, divided into 150,000 shares of par value of two dollars. The men on the directorate of the company are all of Calumet and Houghton.

Hollinger.

Gross profits at the Hollinger for the thirteenth period of the year 1915 amounted to \$220,079. Milling cost showed a decrease of eight cents and mining costs were 12.1 cents down. Total costs fell 20.3 cents a ton. The mill ran 84.6 per cent of the possible running time, treating 41,538 tons, of which 29,947 tons were Hollinger ore and 11,591 tons Aeme. The average value of Hollinger ore treated was \$10.37. Milling costs were down 0.984 a ton and mining costs 1.763 a ton.

Power Rates at Porcupine.

The power rates for most of the mining companies in the Porcupine district have been placed on a flat H. P. basis. Those companies whose contracts had run out have been on a basis of \$40 a h. p. on a three minute peak load basis. This is the basis upon which all companies have been working in Cobalt since the beginning of the year. This change does not effect the Dome and the Hollinger, which by power agreements for the life of the mine have rates which will give them a much lower power cost than this.

Although the snow fall has been so phenomenal in the Porcupine district, the power company is looking ahead for more storage. A dam is being built on the Grassy river to conserve water for the Sandy Falls plant, and a surveyor and party are seeing what possible additional storage may be obtained on the streams and rivers tributary to the Mattagami between Timmins and the Canadian Northern at Rouel.

Porcupine Branch, C. M. I., Meeting.

A very interesting meeting of the Porcupine branch of the Canadian Mining Institute was held in the Masonic hall, Timmins, on Saturday, Feb. 5th. Mr. Ames, superintendent of the Hollinger mill, opened a discussion with a little paper, in which he outlined an attempt to arrive at some method to estimate the comparative merits of crushing machinery. Mr. Ames said that in the Porcupine district the stamps had about the same number of adherents as the ball mill, but the tonnage treated was much larger with the stamps because the Dome and Hollinger and Porcupine Crown were all using stamps. Taking the case of the stamps as against the Hardinge mill, the stamps undoubtedly put through a greater tonnage per h. p., but did not put out quite as fine a product. It had been estimated that the ball mill made about 20 per cent. more fines.

Apparently by one method of computation the Hollinger mill has a little greater mechanical efficiency, but the question in regard to the Porcupine district has yet to be solved. A very interesting discussion followed.

Standard Reopened.

The National Lead and Zinc Co. in Porcupine has commenced work on the old Standard mine, and will at once commence to dewater the old workings. This company which has taken over the Standard, is known as the Porcupine Premier Mines, but it is understood that it is the National Lead and Zinc Co. which is concerned.

Dodds.

The Buffalo syndicate which has the option on the King Dodds claims at Kowkash have decided to sink a shaft to 150 ft. on the vein and are now asking for tenders for the work. It is interesting as constituting the first work of any importance in the Kowkash district.

COBALT, GOWGANDA AND SOUTH LORRAIN

Companies Storing Silver.

All mining companies in Cobalt are storing as much silver as possible in spite of the relatively good price of the white metal. This is due to the fact that the belief is very firm that silver will go to sixty cents and better in a very short time, and that more profits can be made by holding and storing silver than by selling it even now.

Adanac.

A strike below the 265 ft. level on the Adanac property promises to be the most important in Southeast Coleman in the past two years. In the winze at about 275 ft. the vein was very strong with a probability of permanency. When first encountered below the 200 ft. level, it only showed a little ruby silver. Some ore is now being picked from the vein, and the winze is being continued down. In view of the favorable development on the Temiskaming and the deep level mining on the Beaver, there is much activity in options on claims in Southeast Coleman. Geological conditions on a dozen or so properties near by are very similar to those on the Beaver and Temiskaming, and before it is discovered whether there is any ore below the lower contact of the diabase there will be many prospects working in this section of the camp.

Big Master and Laurentian Mines Under Option.

Cobalt companies are taking much interest in western Ontario properties. The Kerr Lake has for some time been developing the St. Anthony mine at Sturgeon Lake; now the Dominion Reduction Co. has taken a six months' option on the Big Master, Laurentian and H. B. 298 properties in the Manitou Lake district in the Lake of the Woods section. They have men at work dewatering and sampling these old properties. All the properties mentioned have been closed down for some time. The Big Master has been worked to the 285 ft. level, previous to 1904, when the lowest level was at 185 ft. \$36,000 in bullion has been extracted. The Laurentian is a much better known property and produced \$180,000 in gold. On the surface it was one of the most spectacular showings that has ever been uncovered in the Dominion. It was worked to the 490 ft. level. H. B. 298 is only a surface prospect containing an extension of the Laurentian leads.

BRITISH COLUMBIA.

Unusually severe winter conditions are somewhat hampering mining operations in districts situated at elevations where snow falls freely. East Kootenay, the various mining divisions of West Kootenay, the copper-mining camps of Boundary district, and the coal-mining regions of the Crowsnest district, Southeast Kootenay, are all affected by heavy snowfall and very sharp frost, so that for the time difficulty is experienced in keeping some of the mines in operation, while railway transportation is much impeded. However, the winter season is more than half over, or it should be in parts where it does not usually last more than three or four months, so relief is looked for as likely to come before many weeks shall have passed.

It is yet too soon to ascertain whether the estimate of mineral production made last month will be found to be approximately correct, which it is believed to be. Official statistics are not yet made up, returns from some of the mines being long in coming in, but in important instances it is found that earlier estimates are not far out.

Profits of B.C. Mining Companies.

The following statement shows the dividends declared by metalliferous mining companies, operating in British Columbia, during the calendar years 1914 and 1915, respectively:

Name of Company.	1914.	1915
Consolidated M & S. Co.	464,376	493,425
Granby Consol. M.S. & P. Co. ..	449,955	449,955
Hedley Gold Mining Co.	300,000	300,000
Le Roi No. 2, Ltd.		58,440
Motherlode Sheep Creek M. Co.		137,500
Rambler-Cariboo Mines, Ltd. ..		35,000
Standard Silver-Lead M. Co. ..	475,000	250,000

Totals\$1,689,331 \$1,724,320

The amount of \$1,724,320 shown above as dividends for the year 1915 by no means represents the total of net profits during that year, for the published accounts of several of the companies for their respective last fiscal years make it clear that in those instances there were as well substantial sums placed to the credit of Profit and Loss accounts. The Consolidated Company's accounts to the end of September, 1915, showed net profits of \$795,411, while the calendar year's total of dividends declared was but \$493,425. The Granby Co., which did not have a full operating fiscal year, made a profit of \$929,165 and disbursed only \$449,955 in dividend distributions. The Hedley Gold Mining Co. in 1914 made net profits totalling \$388,229, while in 1913 the amount was \$405,255, yet the total of dividends paid in those two years was but \$660,000. As this company's production is nearly all gold and its gold-saving plant was added to in 1915, it is quite reasonable to assume that its net profits for that year were somewhere about \$400,000, which would leave a good margin above the amount of \$300,000 paid in dividends during the year. It is of interest to here note that the company's total receipts during five years, 1910-1914, were for that whole period \$3,563,908.45 and its expenditures \$1,794,625.03, which left a net profit (including \$40,692.90, interest received on money in bank) of \$1,769,283.42, of which last amount \$1,488,000 was paid in dividends. As the issued capital of the company is but \$1,200,000, it will be seen that the whole of the issued capital and 24 per cent. besides were returned to shareholders in five years, and 25 per cent. more was paid to them in 1915.

While little information is published usually relative to the net earnings of coal-mining companies operating in British Columbia, it is known that in the case of the Crow's Nest Pass Coal Co., if not in other instances, fairly satisfactory headway has been made in recent years. The following statement, for which the president of the company, Mr. Elias Rogers, was quoted as authority, was published lately: During the last three years the Crow's Nest Pass Coal Co. has paid off all its bills and accounts payable, amounting in 1912 to a total of \$1,081,690. The liability on these accounts was reduced to \$811,605 in 1913, to \$498,241 in 1914, and the balance was entirely cleared off in 1915. A further statement quoted was that "since January 1, 1915, the company has paid off all its indebtedness and it now has a substantial balance at its credit in the bank. All the bonds against its subsidiary companies have been paid, so that there are now no bonds outstanding against any of the companies, nor is there any preferred stock. As far as we can judge the prospects for the coming year are quite as good as, is not better than, the year just closed."

Regarding the outlook for 1916, it may be said that generally this is decidedly promising for a number of the larger operating companies, more so than at the beginning of several successive recent years. Prices of those metals that are subject to market fluctuations—silver, lead, copper, and zinc—are higher than at this time last year. The demand for these metals is active, and there are no similar considerable difficulties attending the marketing of these products such as had not been fully overcome at the beginning of 1915. In other respects conditions are favorable to production on an appreciably larger scale than in the year just closed, and not only for the metalliferous minerals but, as well, for coal and coke. Summing up the situation, then, there seem to be good grounds for expecting that the year now entered upon will prove a record year for mineral production in British Columbia. An unusually heavy snowfall should give an abundant supply of water for placer-gold mining next hydraulicking season; lode-mining will doubtless be on a larger scale than in any previous year; coal-mining will have the benefit of a bigger demand for coke, and probably for coal also; and miscellaneous products may be expected to be more freely used than during the time of uncertainty and hesitation that marked the greater part of 1915. Add to all these things the fact that there is no reason to fear labor difficulties, and the combination of favorable conditions seems to be such that this sanguine expectation of a year of enlarged production and profitable operation from and of the mines of the province would appear to be well warranted.

Ore Receipts at Trail.

The quantity of ore received at the smelting works of the Consolidated Mining and Smelting Co. during four weeks ended January 27, was 32,075 tons of which 26,522 tons was from the company's own mines and 5,553 tons was custom ores. The company's mines and their production were as follows: In East Kootenay; St. Eugene 59 tons, Sullivan 3,137 tons; total 3,196 tons. In Ainsworth camp; Highland 36 tons, No. 1 135 tons; total 171 tons. In Rossland camp; Centre Star group 14,073 tons, Le Roi 9,082 tons; total 23,155 tons. It will be observed that more than two-thirds of the ore was from Rossland mines. The details are as under:

East Kootenay—	Tons.	Tons.
Lead Queen	39	
St. Eugene	59	
Sullivan	3,137	
		3,235

Ainsworth—		
Bluebell	464	
Florence Co.	103	
Highland	36	
No. 1	135	
Utica	84	
		822

Slocan—		
Apex	26	
Black Prince	28	
Comstock	13	
Galena Farm	123	
Hewitt-Lorna Doone	79	
Meteor	15	
Noonday	29	
Ruth	38	
Slocan Star	77	
Standard	756	
		1,184

Nelson—		
Emerald	148	
Queen	65	
		213

Rossland—		
Centre Star Group	14,073	
Josie (Le Roi No. 2, Ltd.) ..	623	
Le Roi	9,082	
		23,778

Boundary—		
Sally	30	
		30

Yale (Kamloops)—		
Iron Mask	155	
		155

State of Washington, U.S.A.—		
Ben Hur, Republic	1,659	
Knob Hill, Republic	194	
United Copper Co.		
Chewelah	748	
Bonanza, Northport	48	
Lead Trust, Northport	9	
		2,658
		32,075

For the corresponding period of 1915 the total was 32,714 tons, in the following proportions: East Kootenay, 2,654 tons; Ainsworth, 58 tons; Slocan, 429 tons; Nelson, 534 tons; Rossland, 27,227 tons; Lardeau, 17 tons; Boundary, 106 tons; Yale, 8 tons; State of Washington, 1,681 tons.

PRODUCTION OF METALS AT TRAIL, B.C.

During the calendar year 1915 the production of metals at the Consolidated Mining and Smelting Co.'s smelter and refinery at Trail, B.C., was, approximately, as under:

Gold, 146,732 oz.; silver, 2,900,639 oz.; Lead, 41,217,668 lb.; Copper, 5,573,965 lb.; zinc (not made public). These figures exhibit the total production of metals, including those from all custom ores some of which came from the State of Washington, as well as ores from the company's own big mines. The total quantity of ores and concentrates received at Trail in

1915 was 441,085 tons, of which 369,148 tons was from the company's own mines, 40,971 tons custom ores from British Columbia mines, and 30,966 tons custom ores from United States mines.

For purposes of comparison, the following figures of metal production are added, so that it may be seen what increases have been made lately:

	Fiscal year ended Sept. 30.	
	1914	1915
Gold, oz., ...	129,083	148,891
Silver, oz., ...	2,568,301	2,230,500
Lead, lb., ...	34,617,318	40,177,910
Copper, lb., ...	3,645,997	5,306,184

It will be seen that the production of silver, lead, and copper was larger in the calendar year 1915 than in either of the fiscal years shown above.

WASHINGTON ORE RECEIVED AT TRAIL, B.C.

Ore receipts at the Consolidated Co.'s smelting works at Trail, B.C., from mines in the United States during the year 1915 were as under:—

From Republic—	Tons.
Ben Hur	15,243
Knob Hill	2,884
Lone Pine	1,594
Longworth	413
Pearl	117
Rathfon	335
San Poil	2,167
Surprise	2,390
Trade Dollar	129
Washington	22
Western Union	35
Wiseman	80
	25,409
Chewelah—	
United Copper	4,750
Bossburg—	
Bonanza	573
Bonanza—	
Inland	12
Colville—	
Old Dominion	41
Northport—	
Great Western	33
Boundary—	
La Plant	21
Meyers Falls—	
Sunday	34
Keller—	
Gold Cord	4
Nighthawk—	
Caaba	48
Jones	29
St. Anthony	5
	82
Bayview, Idaho—	
Conjecture	7
Total	30,966

With one exception, all the United States mines that shipped ore to Trail are situated in the State of Washington. As the total quantity received from Washington in 1914 was 19,594 tons, the increase for 1915 was 11,372 tons.

COPPER IN 1915.

The production of copper in the United States in 1915 passed all previous records, according to the United States Geological Survey. At an average price of about 17.3 cents a pound the output for 1915 has a value of \$236,000,000, compared with \$152,968,000 for the output for 1914.

The figures showing smelter production from domestic ores represent the actual production of most of the companies for 11 months and an estimate of the output for December. According to the statistics and estimates received, the output of blister and Lake copper was 1,365,500,000 pounds in 1915, against 1,150,137,000 pounds in 1914.

The output of refined copper from primary sources, domestic and foreign, for 1915 is estimated at 1,647,000,000 pounds, compared with 1,533,781,000 pounds in 1914 and with the previous record production of 1,615,000,000 pounds in 1913.

At the beginning of 1915 there was about 173,600,000 pounds of refined copper in stock in the United States. This quantity added to the refinery production gives a total available supply of about 1,820,000,000 pounds of refined copper. On subtracting from this amount the exports for the first 10 months and the estimated export for the last two months, it is apparent that the supply available for domestic consumption is materially greater than the 711,624,000 pounds of 1914, no account being taken of stocks held at the close of the year.

The average price of copper for 1915 showed a marked increase over that of the preceding year, being about 17.3 cents a pound, compared with 13.3 cents in 1914.

Arizona made a record production, considerably exceeding the previous record production of 404,000,000 pounds made in 1913.

The output from Montana will be larger than the 236,800,000 pounds produced in 1914, but will not reach a record production for that state.

Michigan, after two years of reduced output, made a record production in 1915, reaching 242,000,000 pounds, as compared with 158,000,000 pounds in 1914.

Utah again shows an important increase over the previous record of 160,500,000 pounds produced in 1914.

The production of Alaska shows a relatively greater increase than any other section, with 83,850,000 pounds in 1915, as compared with 24,985,000 pounds in 1914.

New Mexico will make some increase over the production in 1914—64,200,000 pounds—and will set another record for that state.

California also will show a substantial increase over the previous year's output.

THE BURNSIDE DISPUTE.

Differences of opinion which originated over a deal in mining claims resulted last week in Mr. Justice Sutherland at Osgoode Hall handing out a judgment which occupied about one hundred typewritten pages. Chas. M. Henrotin, of Haileybury, sought to have set aside an agreement by which he assigned options on mining claims in the Townships of Lebel and Teck to Henry Cecil on condition that he received $7\frac{1}{2}$ per cent. of all stock received by a company organized to work the mines, which amount was to total at least two-thirds of the total capitalization. The defendants were Clement A. Foster, Haileybury; Henry Cecil and the Burnside Gold Mines Co., Ltd. Henrotin claimed that the

agreement had not been lived up to, and asked that it be set aside. The defendant company on the other hand counterclaimed that plaintiff by improperly recording two cautions against the lands prevented the company from operating and completing organization, and thus occasioned \$50,000 damages. Mr. Justice Sutherland in his decision gave the plaintiff 30 days to make a declaration that an agreement of January 22, 1914, had been put an end to, and that he is entitled under the agreement of April 16, 1913, to $7\frac{1}{2}$ per cent. of all stock received by Foster and Cecil, the proceeds of the mining claims, then a declaration would be made to that effect without costs. If not the action would be dismissed without costs and without prejudice to any further action under the agreement of April, 1913. The counter-claims would be dismissed.

CHAMBERS-FERLAND.

Cobalt, Feb. 5.—The importance of the recent strike on the Chambers-Ferland can be better understood when it is known that there is at the present time over two cars of screenings ready for shipping and 1,500 bags of high-grade also ready in the ore house. It is the intention of the management to prepare a carload of high-grade ore for shipment about the 15th of the month. The main vein has now been drifted on for about 100 feet and at the breast the vein looks equally as good as at the start. All the ore taken out so far has been in development and yesterday a start was made in stoping, so as to hurry the shipment of the car of high-grade. All the ore is being taken from the drift from the winze at the 426-ft. level.—Cobalt Nugget.

ACTIVITY IN TURNBULL, ROBB AND DELORO TOWNSHIPS.

The "Porcupine Herald" publishes the following notes in its issue of February 5:

The Gold Bullion Mines, Ltd., has bought the Porphyry Hill mine (Preston claims). Mr. C. L. Heath, of South Porcupine has been appointed manager. It is the intention to commence operations without delay.

The Porcupine Premier mine in Deloro is again being operated. Mr. Digby Grimstone is in charge.

Machinery is being taken in to the Lally mine in Robb township. Mr. Geo. H. Benson is in charge.

Some work is being done on claims belonging to J. C. Watson and Dr. McInnis and on the Wettlaufer, Mulleron, Pierce and Jamieson claims. Shaft sinking will be commenced soon on the Jamieson property.

SILVER PRICES.

	New York cents.	London pence.
January—		
25.	57%	27 $\frac{1}{4}$
26.	57	27 $\frac{1}{8}$
27.	56 $\frac{3}{4}$	26 $\frac{1}{8}$
28.	57 $\frac{1}{8}$	27 $\frac{1}{8}$
29.	57 $\frac{7}{8}$	27
31.	57 $\frac{1}{8}$	27 $\frac{1}{8}$
February—		
1.	56 $\frac{7}{8}$	27
2.	56 $\frac{7}{8}$	27
3.	56 $\frac{3}{4}$	26 $\frac{1}{8}$
4.	57	27 $\frac{1}{8}$
5.	57	27 $\frac{1}{8}$
7.	56 $\frac{3}{4}$	27 $\frac{1}{8}$
8.	56%	27

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto.)

As of close of Feb. 7, 1916.

New York Curb.	Bid.	Asked.
Atlantic Steel	50.00	....
Alta. Cons.	19.00	19.12
Butte.	7.87½	8.00
Can. Car	74.75	75.00
Chevrolet.	130.50	131.00
Cosden Oil	19.75	19.87½
Can. Copper	1.75	1.87½
Chandler Motors	91.50	92.25
Cambria Steel	79.00	79.12½
Con. Ariz.	1.62½	1.68¾
Emma Copper	51.00	52.00
First National	6.75	6.87½
Houston Oil	19.00	19.05
Howe Sound	6.62½	6.75
Inter Nickel (New)	51.50	51.62½
Kennecott Copper	51.62½	52.00
Maxim Munitions	7.75	8.00
Midvale Steel	70.37½	70.50
Marconi.	3.62½	3.75
Mother Lode	22.00	22.25
Ray Hercules	3.00	3.12½
Standard Shipbuilding	12.50	13.50
Submarine Boat	37.25	37.50
Tonopah Extension	4.68¾	4.75
White Motors	51.00	51.50

Porcupine Stocks.

	Bid.	Asked.
Apex.	.06¾	.06½
Dome Consolidated	.17	....
Dome Extension	.29	.29½
Dome Lake	.25	.26½
Dome Mines	28.00	28.50
Eldorado.	.00¼	.01
Foley O'Brien	.60	....
Gold Reef	.01¼	.01½
Hollinger.	29.00	30.00
Jupiter.	.22¾	.23
McIntyre.	.97½	.99
McIntyre Extension	.29	.29½
Moneta.	.10½	.11
Porcupine Crown	.81	.83
Porcupine Imperial	.03½	.04¼
Porcupine Tisdale	.01¾	.02½
Porcupine Vipond	.75	.76
Preston East Dome	.03½	.04
Teck Hughes	.17	.18
West Dome	.14	.14½
West Dome Cons. Min	.21	.21½

Cobalt Stocks.

	Bid.	Asked.
Adanac.	.50	.60
Bailey.	.05½	.05¾
Beaver.	.39½	.40½
Buffalo. ....	....	.90
Chambers Ferland	.25	.28½
Coniagas.	4.20	4.85
Crown Reserve	.46	.46
Foster.	.15	.16
Gifford.	.06¼	.06¾
Gould.	.00½	.01
Great Northern	.03½	.05
Hargraves.	.03½	.04
Hudson Bay	25.00	....
Kerr Lake	4.40	....
La Rose	.66	.68
McKinley.	.47	.49

Nipissing.	7.20	....
Ophir.	.07	.08
Peterson Lake	.25¾	.26½
Right of Way	.05½	.06
Seneca Superior	.63	.66
Shamrock Cons.	.16½	.18
Silver Leaf	.02	.02½
Temiskaming.	.66	.67
Trethewey.	.16	.17
Wettlaufer.	.08	....
York Ontario	.00¾	....

NEW YORK MARKETS.

Feb. 8, 1916—Connellsville coke—

Furnace, spot, \$3.25 to \$3.50.

First half, 2.35 to \$2.50; year 1916, \$2.25 to \$2.35.

Foundry, prompt, \$4.00 to \$4.50.

Foundry, contract, \$3.25 to \$3.75.

Feb. 8, 1916—Straits, tin, f.o.b. 41.25 cents.

Copper—

Prime Lake, nom., 26.50 to 27.50 cents.

Electrolytic, nom., 26.50 to 27.50 cents.

Casting, nom., 25.00 to 25.50 cents.

Lead, Trust price, 6.10 cents.

Lead, outside, 6.10 to 6.20 cents.

Spelter, prompt western shipments, 19.17½ to 19.42½ cts.

Antimony—

English brands, nominal.

Chinese and Japanese, 43.50 to 44.00 cents.

American, 43.50 to 44.00 cents.

Aluminum—

No. 1 Virgin 98-99 per cent., 54.00 to 56.00 cents.

Pure 98-99 remelt, 52.00 to 54.00 cents.

No. 12 alloy remelt, 43.00 to 45.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$275.00 to \$300.00.

Platinum—

Nominal, \$88.00 to \$100.00.

Cobalt (metallic), \$1.25.

Silver (official), 56¾ cents.

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 33.00 cents.
Copper wire, base, 27.75 to 28.25 cents.
High sheet brass, base, 36.00 to 38.00 cents.
Seamless brass tubing, 41.00 to 43.00 cents.
Seamless copper tubing, 41.50 to 43.50 cents.
Brazed tubing, 43.00 to 45.00 cents.
Brass wire, 36.00 to 38.00 cents.
Brass rods, 36.00 to 38.00 cents.
Sheet zinc, f.o.b. smelter, 24.00 cents.

TORONTO MARKETS.

Feb. 11—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 7¾ cents per lb.

Tin, 47 cents per lb.

Antimony, 48 cents per lb.

Copper casting, 28 cents per lb.

Electrolytic, 28 cents per lb.

Ingot brass, yellow, 13c.; red, 15 cents per lb.

Feb. 10—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8.00 per ton.

Coal, bituminous, \$5.25 per ton.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario Cohen, S. W. Campbell & Deyell. Carter, W. E. H. Ferrier, W. F. Forbes, D. L. H. Gwillim, J. C. Hassan, A. A.	Haultain, H. E. T. Segsworth, Walter E. Smith, Alex H. Smith, Sydney. Maurice W. Summerhayes. Tyrrell, J. B.	Quebec Burchell, Geo. B. Cohen, S. W. DePencier, H. P. Hardman, J. E. Hersey, Milton L. Johnson, W. S. Smith, W. H.	British Columbia Brown & Butters. Fowler, S. S. FOREIGN-New York Canadian Mining & Exploration Co., Ltd. Colvocoresses, Geo. M. Dorr, Jno. V.N. Hassan, A. A.
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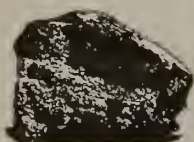
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TORONTO

No. 5

In This Issue:

The proposed tax on Mining Companies.

Mining in Slocan District, British Columbia.

Flotation at Anaconda.

Flotation Methods.

Production of Ontario Mines in 1915.

Estimated Mineral Production of Canada in 1915.

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The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.

Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.

The Bituminous Sands of Northern Alberta. Report on, by S. C. Ells, M.E.

Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.

Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.

The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.

The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.

Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.

Electro-thermic Smelting of Iron Ores in Sweden. Report on, by A. Stansfield, D.Sc.

Non-metallic Minerals Used in Canadian Manufacturing Industries. Report on, by H. Frechette, M.Sc.

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Memoir 34. The Devonian of Southwestern Ontario, by Clinton R. Stauffer.

Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

Memoir 56. Geology of Franklin Mining Camp, British Columbia, by C. W. Drysdale.

Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.

Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.

Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.

Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.

Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.

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Memoir 76. Geology of the Cranbrook Map-area, British Columbia, by S. J. Schofield.

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Memoir 81. The Oil and Gas Fields of Ontario and Quebec, by W. Malcolm.

Memoir 82. Rainy River District of Ontario. Surficial Geology and Soils, by W. A. Johnston.

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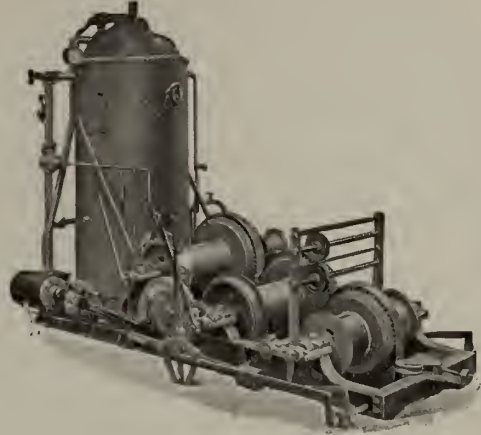
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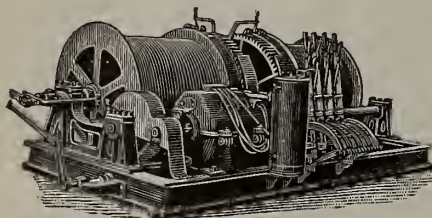
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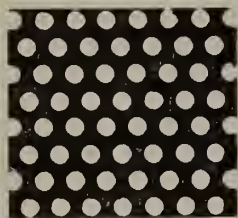
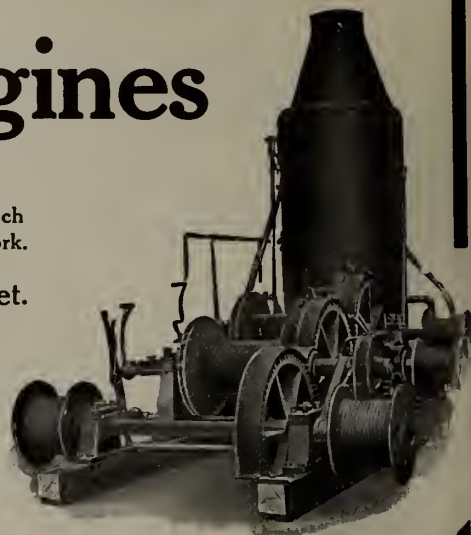
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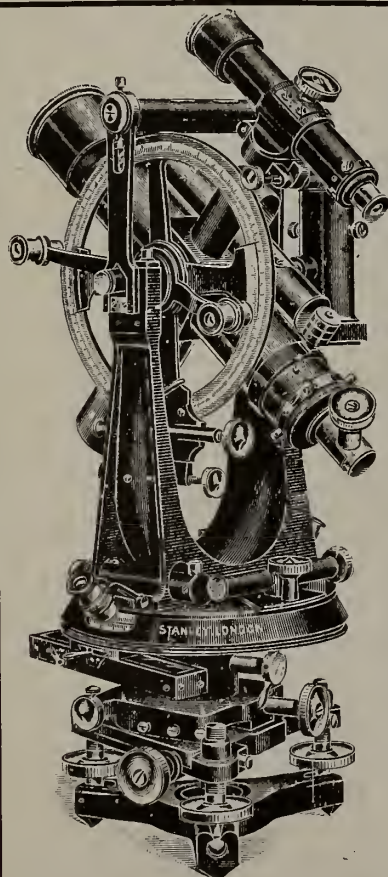
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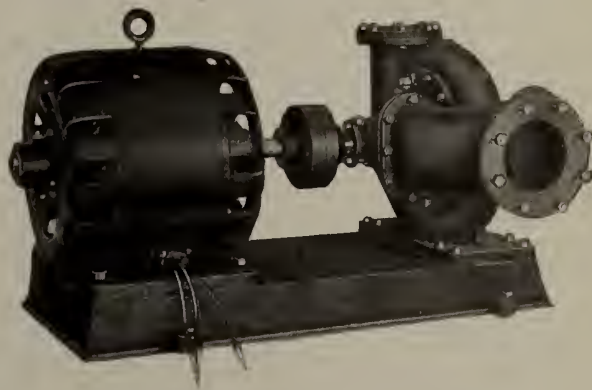
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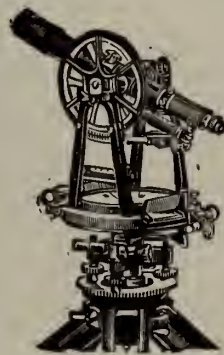
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THE CANADIAN MINING JOURNAL

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THE PROPOSED TAX ON MINING PROFITS

One of the most dangerous proposals with which the mining industry of Canada has yet had to contend has been made by the Hon. Sir Wm. Thomas White, Minister of Finance. It is seldom that a Minister is called upon to meet so many difficulties in a few years as has Sir Thomas, and it is fortunate for Canada that such an able man fills the important office of Minister of Finance at this time. All admire the skill and courage with which he has met new conditions as they have arisen. His proposal to single out one of Canada's chief basic industries for especially heavy taxation was therefore unexpected. The Minister having well earned the confidence of the people, mining men on reading newspaper accounts of the proposed tax on profits assumed that special provision had been made to provide for fair treatment of mining companies. If such is the case, and we still trust that it is, no announcement has been made.

It is an axiom of good government that basic industries should be encouraged. Sir Thomas seems to recognize this when he singles out agriculture for favorable treatment. Agriculture is Canada's greatest basic industry and well merits the fostering care of our government. Mining is, next to agriculture, our greatest basic industry. It might have been expected that Sir Thomas would therefore show some concern for the future of the mining industry. What he proposes, however, is quite the contrary. He would tax the mining industry more severely than any other industry in the country.

The grossly unfair treatment of successful mining companies has not been pointed out by the Minister in the House. He has so worded his proposal that discrimination against mining companies is not apparent to those who are unfamiliar with the mining industry. By putting companies of so many kinds in one class he strikes a blow at mining in an effective manner without the average citizen realizing the injustice and shortsightedness of it. A producing mine is a wasting asset. Sir Thomas knows it. Why does he ignore the fact?

Development of our resources and increase in production should be the aim of our government at all times and particularly now. Why does Sir Thomas propose to discourage mining companies from increasing production? Why does he discourage the investment of foreign capital?

It must, of course, be admitted that a Minister of Finance in these days has an extremely difficult task. It is easy to criticize his proposals, for new methods of taxation must be devised to meet the war expendi-

tures, and new methods are almost sure to result in distributing the burden unevenly. Sir Thomas undoubtedly wants to place it on those most able to bear it. Many have made fortunes out of Canada's mines, and the Minister naturally considers that such persons should contribute freely. A reasonable tax on the profits of successful mining companies, in spite of the fact that mining, like agriculture, is a basic industry and deserving of the fostering care of Government, might, under the circumstances, have been accepted by mining men without protest. An unfair tax such as Sir Thomas proposes is, however, beyond all reason.

Sir Thomas said in his budget speech that seven per cent. per annum is, in normal years, a reasonable profit on the paid up capital of a mining company. Think of it, and imagine if you can that a Minister of Finance in a country like Canada, in which mining is one of the chief basic industries and which has enormous undeveloped mineral resources, stating on the floor of the House that seven per cent. per annum is, in normal years, a reasonable profit on the paid up capital of a mining company. The statement is absurd, and yet, so far as we have been informed, it was scarcely commented on in the House, but swallowed whole by our representatives.

The life of a mine is short. The profitable life is shorter. In Ontario the profitable life of most mines is less than ten years. How would you like to invest your money in a mine that would yield you seven per cent. for ten years and eat up your invested capital in that time? What would the people think if our Minister of Finance should propose to invest Government funds in such an enterprise? Can you imagine Sir Thomas making such a proposal?

Mining is attractive because it frequently yields large profits. Mining men take risks because the prizes are big. Undeveloped ore is of doubtful value. It takes money and labor to develop ore and determine whether it can be mined profitably or not. Money spent in exploration and development is often a total loss. If there were no rich prizes there would be little development of our mineral resources. If such a tax as Sir Thomas proposes were enacted, development of Canada's mineral resources would undoubtedly be checked.

In accepting the challenge of Germany to fight for our possessions Canada has accepted a financial burden which makes the development of our resources more necessary than ever. We should and could greatly increase production. During 1916, if Sir Thomas modifies his proposal, there will be a great increase in mining activity in Canada. It is to be hoped that further consideration of possible results of the proposed legislation will result in more favorable treatment of mining companies.

We believe that Canada's mineral resources are great and that with due care on the part of the Government the production in 1916 will be much larger than ever, and that future years will see great increases in output. Ore undiscovered is, however, of

no present value, and ore undeveloped is of doubtful value. To make our mineral resources a source of revenue there must be an expenditure of capital and labor. These are the main sources of profit in mining. Both must be treated with consideration.

Increased production from the mines will help us to pay the cost of the war. Severe taxation of mining companies will not do it. Does Sir Thomas want to kill the goose?

Since the above was written we have been advised that Sir Thomas' proposals will be modified and that when the bill is introduced it will be found to contain provisions which the Finance Minister thinks will meet the criticisms which have been offered.

On Thursday, Feb. 23, in reply to questions in the House, Sir Thomas intimated that in the case of mining companies provision would be made for a partial return of capital investment.

It appears that either the Minister has been, by criticism, convinced that the original proposal is dangerous or that his original proposal has been misinterpreted. In one of his statements on Thursday, Feb. 23, he said that "the profits to be taken will be net profits." This might be interpreted to mean profits after return of capital has been provided for. These intimations make us wonder whether Sir Thomas has not been misunderstood.

Perhaps, instead of criticizing Sir Thomas we should blame the system of bookkeeping adopted by Canadian and American mining companies. Few companies operating in Canada make provision in their financial statements for return of capital. The International Nickel Company is one of the few concerns which shows on its annual balance sheets a large charge against "mineral exhaustion." Most mining company books show no such item, and none of our Canadian companies show provision for return of capital expended on the properties. Hence most mining men think of profits as inclusive of a partial return of capital. Sir Thomas, having another idea of what is meant by the term "net profits," may not have had any intention of taxing mining companies so severely as we imagined. Possibly that is why the confidently expected announcement of special treatment for mining companies has not been made.

Deloro Township is to be the scene of considerable activity this year. The announcement that the Armstrong-McGibbon and the Maidens-McDonald claims are to be worked under options held by Mr. Clifford E. Smith and Mr. G. C. Bateman will arouse new interest in this township.

An interesting feature of the proposed tax is the liability of the International Nickel Company. This company's chief assets are the mines and smelter in the Sudbury district, operated by the Canadian Copper Company. The Nickel Company's profit is not all made in Canada, however, for the refinery and sales departments make their share in the United States and are not liable for the Canadian tax.

MINERAL PRODUCTION OF CANADA IN 1915

(Subject to Revision.)

As estimated by John McLeish, Department of Mines.

Metallic.		
Product.	Quantity.	Value.
Antimony, lb.	961,040	\$192,208
Cobalt, metallic, lb.	211,610	
Cobalt, oxide, lb.	379,219	502,388
Nickel, metallic, lb.	55,325	
Nickel, oxide, lb.	200,032	42,193
Copper, valued at 17.275c. per pound, lb.	102,612,486	17,726,307
Gold, oz.	916,076	18,936,971
Iron pig from Canadian ore, tons	158,598	1,740,808
Iron ore sold for export, tons	93,444	187,682
Lead, valued at 5.60c. per pound, lb.	45,377,065	2,541,116
Molybdenite, lb.	28,600	28,460
Nickel, valued at 30c. per pound, lb.	68,077,828	20,423,348
Silver, valued at 49.604c. per pound, oz.	28,401,735	14,088,397
Zinc ore, tons	15,553	636,204
Total		\$77,046,082

Non-Metallic.		
Product.	Quantity.	Value.
Actinolite, tons	220	\$2,420
Arsenic, white, tons	2,291	141,830
Asbestos, tons	113,115	3,491,450
Asbestic, tons	25,700	21,819
Chromite (a), tons	11,486	162,618
Coal, tons	13,209,371	31,957,757
Corundum, tons	262	33,138
Feldspar, tons	15,455	59,124
Graphite, tons	2,610	121,023
Grindstones, tons	2,580	35,768
Gypsum, tons	470,335	849,928
Magnesite, tons	14,779	126,535
Manganese (b), tons	47	5,460
Mica		81,021
Mineral Pigments—		
Barytes, tons	550	6,875
Ochres, tons	6,248	48,353
Mineral water		118,796
Natural gas, M. cu. ft.	18,319,710	3,300,825
Product.	Quantity.	Value.
Petroleum, value at \$1.395 per barrel, bbls.	215,464	300,572
Phosphate, tons	217	2,502
Pyrites, tons	296,910	1,028,678
Quartz, tons	127,108	205,153
Salt, tons	119,900	600,226
Talc, tons	11,885	40,554
Tripolite, tons	317	12,119
Total		\$42,755,594

Fireclay, drain tile, pottery, etc.	781,071
Kaolin, tons	1,300 13,000
Lime, bushels	4,932,767 1,015,878
Sand and gravel	2,098,683
Sand-lime brick, No.	23,211,802 182,651
Slate, sq.	397 2,039
Stone—	
Granite	1,634,084
Limestone	2,504,731
Marble and Sandstone	365,784
Total structural materials and clay products	\$18,712,074
All other non-metallic	42,755,594
Total value, metallic	77,046,082
Grand total, 1915	\$138,513,750

(a) Additional returns make the Chromite production 14,291 tons, value \$208,718; (b) Exports are reported as 255 tons, valued at \$6,855.

TOUGH-OAKES.

Haileybury, Feb. 26.—On behalf of the Tough-Oakes Mine, as plaintiff, a writ has been issued against the present Board of Directors, consisting of Messrs. Harry Oakes, R. J. Robins, P. W. Morrisou, W. H. Wright, J. B. Holden, Albert Burt and J. Y. Murdock, for fifty thousand dollars damages, which the plaintiff claims for "tort and illegal and wrongful interference by the defendants with the working of the plaintiff's company." The case is expected to be one of the biggest actions ever heard in the North Country.



MR. A. A. COLE

President-Elect, Canadian Mining Institute

Structural Materials and Clay Products—		
Cement, Portland, bbls.	5,681,032	\$6,977,024
Clay products—		
Brick, common, pressed, paving		2,341,483
Sewer pipe		795,646

MINERAL PRODUCTION OF ONTARIO IN 1915

A Preliminary Report by T. W. Gibson, Deputy Minister of Mines.

The rapid growth which marked the mineral production of Ontario for a decade prior to 1914 received a severe check in 1914, owing in part to business depression, but chiefly to the outbreak of war and the consequent disturbances in industrial and financial conditions. In 1915 there was a turn in the tide with an increase in production over 1914. Gold exhibits a large advance, offset to some extent by decrease in silver production. Nickel and copper show what would be in times of peace considered abnormal increases. The demand for these metals for munition purposes has been great, and increased prices have stimulated production to the maximum capacity of the mines.

The following table, subject to revision, summarizes the mineral output of Ontario for 1915, with comparative values of different items for 1914:

	Quantity.	Value 1915.	Value 1914.
Gold, oz.	411,588	\$8,501,391	\$5,529,767
Silver, oz.	23,730,839	11,742,463	12,795,214
Copper ore, tons...	271	4,418	.....
Copper in matte, tons.....	19,608	3,921,600	2,081,332
Nickel in matte, tons.....	34,039	17,019,500	5,109,088
Iron ore, tons	394,054	764,515	531,379
Pig iron, tons	493,400	5,910,625	7,041,079
Cobalt ore, tons...	177	21,464	27,743
Cobalt (metallic), lb.....	111,588	103,746	.....
Cobalt oxide, lb. ..	314,906	254,447	518,736
Nickel (metallic) lb	11,905	4,762	.....
Nickel oxide, lb....	145,323	17,968	27,716
Other cobalt and nickel products, lb.	75,447	9,227	45,189
Molybdenite ore, tons.....	192	12,859	.....
Molybdenite concentrate, lb.	1,068	1,240	.....
Net value metallic production	\$47,721,180	\$33,345,291	
Non metallic products	9,811,664	12,950,668	
Total value mineral production	\$57,532,844	\$46,295,959	

Gold.—The producing gold mines in Ontario in 1915 were seventeen in number, twelve being in Porcupine. Some of the large producers were:

	Tons Milled.	Ounces Recovered.	Value per ton.
Hollinger	334,750	156,575	9.67
Dome.	317,740	73,726	4.79
Acme.	106,486	49,933	9.69
McIntyre.	101,955	36,094	7.31
Poreupine Crown	46,419	29,032	12.92
Tough-Oakes	26,196	26,658	21.04
Vipond.	35,899	11,871	6.83

Other gold producers were: Dome Lake, Gold Reef, Schumacher, Porcupine Pet, Mines Leasing Co. (Rea), Porphyry Hill, Croesus, Canadian Exploration Co., Cordova and Olympic.

Silver.—The production of silver by camps was:

	Oz.	Value.
Cobalt proper	23,187,545	\$11,481,265

Casey township	223,939	105,846
Gowganda.	242,229	116,856
Silver from gold ores	77,126	38,496
	\$23,730,839	\$11,742,463

Nine companies each produced over 1,000,000 oz. in 1915:

	Oz.
Nipissing.	4,610,051
Mining Corporation (Townsite)...	2,776,589
Kerr Lake	2,109,355
Seneca Superior	2,109,355
Coniagas.	1,996,257
Mining Corporation (Cobalt Lake)	1,566,206
Temiskaming.	1,486,400
La Rose	1,071,694
McKinley - Darragh - Savage.....	1,061,827

As to the future of the Cobalt camp, there is little doubt that the decline in output which began in 1912 will continue. Several of the companies are developing old prospects which have not received attention since the first years of the camp's life.

Nickel and Copper.—Heretofore the low valuation placed on the nickel-copper matte by the producing companies has been accepted for statistical purposes. In 1914 these figures were 11.2 cents per lb. for nickel and 7.2 cents for copper. Exact values cannot be obtained, for the reason that nickel-copper matte is not a commodity bought and sold in the open market. The basis of valuation for 1915 has been fixed by the Bureau of Mines at 25 cents per pound for nickel and 10 cents for copper. These figures are conservative, in view of the fact that the average price of refined copper in 1915 was about 17 cents, and that the nickel refined in Ontario in 1915 was sold at 40 cents per lb.

The quantity of nickel-copper ore raised in 1915 was 1,325,973 tons, of which 11,923 tons came from the Alexo mine in Dundonald township, as against 7,982 tons in 1914. Ore smelted by the Canadian Copper Co. and Mond Nickel Co. was 865,169 and 407,144 tons respectively.

Legislation.—The Canadian Minister of Finance announced Feb. 15, 1916, that a special business tax for war expenses would be levied on companies, including mining companies, with a capital of over 50,000, to the extent of one-quarter of all profits in excess of seven per cent. The measure is to be retroactive and to cover the three year period from Aug. 4, 1914, to Aug. 4, 1917. In most commercial enterprises large annual returns mean the building up of the business or property, while mining profits are taken from real capital and mean an exhaustion of ore reserves. The War Revenue Bill promises to be most important in its relation to the mining industry.

Dividends.—During the year dividends paid by silver mines operating in the Cobalt are amounted to \$4,441,948. The total return to shareholders up to the end of 1915 reached \$59,660,912.

Up to the end of 1914 two Porcupine gold mines, Hollinger and Poreupine Crown, had paid dividends amounting to \$2,850,000. During 1915 the Dome and Tough-Oakes have been added to the list. The total paid by gold mining companies to Dec. 31, 1915, amount to over \$5,000,000.

IMPORTANT FACTORS IN THE OPERATION OF THE CYANIDE PROCESS*

By G. H. Clevenger.

Inasmuch as the cyanide process is of vital importance in the present-day hydrometallurgy of gold and silver, a discussion of the more important controlling factors of the process is in order.

The degree of comminution of the ore is one of the most important factors, particularly in the treatment of silver ores. The purpose of grinding is to free the gold and silver minerals from the enclosing gangue and to reduce the mineral particles to such a size that they are readily dissolved. Grinding should be carried on in such a manner as to waste as little power as possible in grinding the worthless gangue and still fulfil the above named conditions to the fullest extent possible, since the less the mineral is protected by the gangue and the greater the surface of the mineral exposed to the solution, the more rapid the rate of dissolution.

It then follows, for example, in the case of certain silver ores, that while fine grinding may not produce any greater ultimate extraction, yet in general it will materially reduce the time of treatment necessary. But this advantage is not always realized without the disadvantage of greater consumption of cyanide arising, since finer grinding not only causes a greater surface of the minerals containing the precious metals to be exposed to the solution, but also a greater surface of those minerals, if present, which may act as cyanicides. Careful correlation of the time of treatment with degree of comminution may serve to minimize this difficulty.

Selective grinding whereby the heavy mineral particles are ground finer than the lighter particles of gangue takes place automatically to a greater or less degree in closed circuits where hydraulic or mechanical classifiers are employed so that actually in the majority of plants the heavy mineral particles are ground finer than the gangue. The additional cost of finer grinding, together with the attendant disadvantages which may arise, must in each case be carefully weighed against the additional extraction possible, or the decreased time of treatment necessary to obtain a given extraction.

The concentration of the solution of cyanide is a vital point. In general, the stronger the solution, within certain fairly well defined limits, the more rapid the dissolution, and, furthermore, the less the interference of a given percentage of impurity which might be present in solution. On the other hand, a greater proportion of impurity may be dissolved by the stronger solution. In the case of a plant which is operating at forced capacity a stronger solution may be used to advantage in order that the maximum extraction may be attained under this condition of operation. Stronger solutions may result in increased cyanide consumption, although the magnitude of this loss in a properly operated plant is not so great as has been supposed.

However, in a plant where there is considerable mechanical loss of solution the additional cyanide loss would prove an important factor. For this reason a strong solution is not generally favored when continuous decantation is used. The tendency in some cyanide plants has been to use a lower concentration in cyanide than that capable of giving the highest economical result. This probably is through the fear of excessive cyanide loss.

The alkalinity both as regards the kind of alkali and its concentration is perhaps only second to the concentration of the solution in cyanide in importance. The effective alkalies are the alkaline hydroxides, the most available being caustic soda and lime. Lime in contact with the solution becomes calcium hydroxide, slightly soluble, but sufficiently soluble to be effective as an alkali in cyanide treatment. Lime in the majority of localities is much cheaper than caustic soda and, fortunately, is in the majority of cases the most satisfactory alkali to use. Many of the impurities which form soluble sodium salts form with calcium insoluble compounds which are eliminated with the tailing, thereby maintaining the solution at a higher degree of efficiency. There is evidence to indicate that when certain antimonial minerals are cyanided caustic soda may prove the more satisfactory alkali; this, however, is not definitely proved, and most certainly is not true in all cases.

The concentration of alkali, or as it is usually termed the protective alkali, may vary from practically 0 to 100 points. At the Homestake a very low alkalinity is conducive to the best extraction, while in treating raw Cripple Creek ores a rather high alkalinity, employing lime, results in the highest extraction and the lowest consumption of cyanide.

Dilution or ratio of solution to dry ore in the pulp undergoing treatment is generally recognized as a factor to which proper attention must be paid if the highest extraction is to result. If a higher dilution is used than is necessary the capacity of the plant is cut down, and, on the other hand, if the dilution be too low the maximum extraction is not attained. It is quite impossible to give general figures for minimum dilution as these figures vary for different ores. In general, lower dilutions can be used with gold ores than with silver ores, probably on account of the greater weight of metal to be dissolved in the latter case. Other conditions being equal, it appears that lower dilutions can be used with the Pachuca agitator than with the mechanical agitator on account of the greater proportion of air brought in intimate contact with the pulp.

The time of treatment depends upon the character of the silver and gold minerals and upon their degree of comminution, and, as previously pointed out, also upon the concentration or strength of the solution in cyanide. It therefore follows that finer grinding, or increase of the cyanide concentration of the solution, or both, will in general result in reducing the time of treatment necessary. In cases where the cost of power is high, and as a consequence the cost of fine grinding would be excessive, the ore may be ground to the point where the minerals are liberated from the gangue and then separated into sand and slime, the slime being treated by agitation followed by either decantation or filtration. The sand containing the coarse mineral particles requiring a long period of contact with the solution for dissolution can be given the long period of contact necessary at a reasonable cost by leaching. Cases of this kind clearly indicate where combined sand and slime treatment can be employed to advantage.

The method of precipitation employed, assuming equal efficiency as regards the precipitation and recovery from solution of the precious metals, may exert an important influence upon extraction, either through introduction of the precipitant used into solution or its failure to precipitate certain interfering elements. For example, zinc in the presence of arsenic may interfere in the treatment of certain ores. If aluminum

*Extract from paper presented at the Second Pan-American Congress, Washington, D.C., January 8, 1916.

precipitation is used the difficulty is overcome through the elimination of zinc. When copper reaches a certain concentration in solution difficulties arise with both extraction and precipitation. Neither zinc nor aluminum precipitate copper to any extent, hence if copper is to be removed from solution electrolytic precipitation must be used.

Carbon, which at times occurs in gold and silver ores, may occasion difficulty in cyanidation. It has been generally assumed that carbon occurs in gold and silver ores in the form of graphite, but the evidence available by no means supports this view in all cases. The two extremes of carbon as regards its behavior in cyanide solutions are graphite and charcoal. Graphite is dense and does not possess pores, therefore cannot occlude gases, while charcoal is porous and has the property of occluding relatively large volumes of gases. Graphite does not precipitate gold and silver from cyanide solutions while charcoal does. Intermediate between these two extremes are various forms of carbon which will precipitate gold and silver to a greater or less extent.

The only gold ore containing carbon which I have had an opportunity of investigating carefully showed but little tendency to cause premature precipitation. This fact, together with its general appearance, led to the conclusion that the carbon in this ore was largely graphite. However, the graphite was found to definite-flocculation of the colloidal portion of the ore including the graphite gave negative results, but it was discovered that if the physical state of the graphite were altered, most conveniently by heating, that the extraction was wonderfully improved.

Practically all gold or silver ores can be treated by the cyanide process or by the cyanide process in combination with some other preliminary or accessory treatment, with the exception perhaps of certain ores containing a considerable amount of copper, lead, etc. In such cases, the desirability of recovering the base metals leads to smelting the ore upon either the lead or copper basis, and the necessity for hydrometallurgical treatment for the recovery of the gold and silver disappears since the precious metals are recovered by the smelting operation in connection with the base metals. Despite the fact that most ores can be successfully treated by the skillful application of the cyanide process, either alone or in combination with other accessory operations, it cannot be said that such treatment is always profitable, so that much remains to be done in the way of simplifying and lowering the operating costs of hydrometallurgical processes for the treatment of gold and silver ores, and in many cases improving the percentage of extraction.

CHAMBERS-FERLAND.

Cobalt, Feb. 26.—Sinking at the Chambers-Ferland has been resumed. Stopping at the 90-ft. drift at the 426-ft. level has been going on for about ten days in order to complete a carload shipment of high-grade. The latter car will be shipped next week.

DOMES MINES.

President J. R. De Lamar of the Dome Mines Co., says regarding the proposed Canadian war tax: "The trivial payment of 35 cents a share which Dome would have to contribute to this war taxation will be paid with the greatest pleasure, notwithstanding that I own over one-quarter of the outstanding stock."

TO DIAMOND DRILL IN THE PAS COUNTRY.

According to stories reaching Cobalt from The Pas, considerable activity in the way of prospecting is likely to occur in the spring. Four diamond drills are said to have been shipped from Sudbury. These should be on the ground very soon. It is understood that Messrs. Smith & Durkee have a 50,000 drilling contract with the Hammell Syndicate, which owns property near Flin Flon Lake.—Cobalt Nugget.



MR. G. G. S. LINDSEY

Retiring President, Canadian Mining Institute

PORCUPINE KEORA MINE.

The Keora property situated north-east of Porcupine Lake, Ont., is now under option to an American company. The Keora was organized in 1911 by Mr. William B. Gunton, of Toronto. Mr. Gunton explored the surface and its vein system very extensively. He is said to have found strong veins with good values, and to have sunk a shaft sixty feet on the widest of the lodes. The financing depended upon sale of stock, and Mr. Gunton, like many other Porcupine promoters, was, after the fire in 1911, unable to interest the public and therefore forced to discontinue the work. From that time until now the mine has been idle. Mr. A. J. Brant, who will be in charge for the holders of the option, states the work will be started at once, and a shaft sunk to 200 ft. This work will probably be let out to contractors.

A despatch to Washington from the United States consul at Johannesburg, South Africa, gives the information that the gold output of the Transvaal for 1915 was 9,093,671 oz., as compared with 8,394,322 oz. for 1914.

FLOTATION CONCENTRATION AT ANACONDA*

By Frederick Laist and Albert E. Wiggin.

Early in 1914 it was decided to test, on a fairly large scale, the treatment by flotation of Anaconda slime and mill tailing. For this purpose a standard-type Minerals Separation machine was installed at the Washoe Reduction Works during May and June, 1914. This was followed by the installation of a full-size Callow pneumatic machine plant. Experiments were also made, on a smaller scale, with the Froment, the Towne, the Fields, and the Anaconda flotation machines. The last-named machine was developed at this plant. In addition to the tests made in the standard-type Minerals Separation machine some tests were made using a Minerals Separation machine of the sub-aeration type.

During the series of experiments a large variety of oils was tested. Experiments were also conducted using both round-table feed and tailing to determine whether it would be better to displace the round tables by flotation for the treatment of the slime, or to supplement the round tables by flotation of the round-table tailing.

A series of tests was also made on the treatment of the mill tailing by grinding followed by flotation to determine the relative merits of flotation and leaching for the treatment of this product. In addition, flotation tests were made on mixtures of mill tailing and slime.

The round-table feed referred to above is the total slime from the mill. It contains about 35 per cent. colloidal solids and approximately 90 to 95 per cent. of the total solids will pass through 200 mesh (0.067 mm.). It assays from 2.3 to 2.6 per cent. Cu.

The mill tailing referred to above is the total discard from the mill, exclusive of the slime. It is all finer than 2 mm. and about 90 to 95 per cent. will remain on 0.25 mm. It assays about 0.60 per cent. Cu.

A brief summary of the experimental flotation results follows:

A series of tests was first carried out to determine roughly the best conditions for flotation, using the standard Minerals Separation machine and treating round-table feed: The following reagents were tested either alone, or in combinations: Turpentine, crude oil, cresylic acid, stove oil, tar oil, Carolina oil of tar, argols, sludge acid, fuel oil, wood creosote, and sulphuric acid. In some of these tests sulphuric acid was used and in others it was omitted. Also, the effect of the temperature of the pulp upon the flotation results was tested by heating to various temperatures.

As these tests were merely preliminary, no record was kept of the amount of reagents used. It was conclusively proved, however, that the best combination of reagents was sludge acid, wood creosote, stove oil and sulphuric acid. Fortunately, of all the reagents tested, these happened to be the cheapest. It was also proved that the addition of sulphuric acid to the pulp was of decided advantage in the treatment of the slime. In two successive tests in which sludge acid, wood creosote, and stove oil were used, the tailing assayed 1.25 per cent. Cu when no acid was used and 0.3 per cent. Cu when acid was used. Since these tests were made we have omitted the use of stove oil.

Tests With Standard Minerals Separation Machine.

This machine, with the accessory apparatus, was installed in a separate building, south of the round-table plant. It had 16 agitator compartments, each 2 feet

square, and 14 spitzkastens, and was of the standard Minerals Separation design. This machine is known by us as M. S. Machine No. 1. The agitators were of the standard Minerals Separation type, the impellers being 18 inches in diameter and the agitators making 265 r.p.m. This gave the impellers a peripheral speed of 1,245 feet per minute. The machine required 45 to 55 h.p., including motor and belt transmission loss, when operating under a full load of slime pulp.

We wish at this point to express our appreciation of the able manner in which the experimental work on the Minerals Separation machine was carried out by George A. Chapman, and staff, of the Minerals Separation Co.

The first products to be tested were the round-table feed and tailing. Conclusions from these tests were:

1. The economic capacity of the M. S. No. 1 machine when treating slime as produced from the mill at present (May 1st, 1915) seems to be from 80 to 90 tons.

2. The best combination of reagents for the treatment of slime seems to be sulphuric acid, kerosene sludge acid, wood creosote and stove oil. There is some question as to the real value of the stove oil. Its principal function seems to be to make a more compact froth.

3. It would not be economical to retain the round tables as the recovery by treating the slime directly by flotation is just as high as by retaining the round tables and treating the round-table tailing by flotation. The grade of concentrate would probably be the same in either case, but any difference would be in favor of treating the round-table feed directly by flotation. The heating of the round-table tailing pulp, on account of its low density, would increase the cost of the flotation.

4. In treating the round-table feed directly by flotation, the resulting tailing should assay 0.30 per cent. Cu, or less, with a concentrate carrying not over 40 per cent. insoluble. Possibly the concentrate can be made much cleaner with no sacrifice in the recovery.

5. It is thought that the best circuit density for the slime pulp for flotation treatment is about 12 per cent. solids.

6. It is thought that about 70 degrees F. will be found to be the most economical temperature at which to keep the pulp.

7. Acid seems to be absolutely essential to the successful treatment by flotation of our slime.

8. The addition of air in the last spitzkasten is of no advantage.

9. Any considerable increase in speed of the agitators above a peripheral speed of about 1,300 feet per minute seems to be disadvantageous.

From the treatment of mill tailing after grinding through 60 mesh, the following conclusions were drawn:

1. Although not definitely demonstrated, it is thought that the economical capacity of the M. S. No. 1 machine when treating sand tailing crushed through 60 mesh is about 175 to 200 tons per 24 hours.

2. The best combination of reagents seems to be sludge acid kerosene and sulphuric acid. However, a mixture of creosote, turpentine, and pine oil, in a non-acid circuit gave good results also. The non-acid circuit, however, seems to require more delicate adjustment and more careful attendance than the acid circuit.

*Extracts from a paper to be presented at the Arizona meeting of the American Institute of Mining Engineers, Sept., 1916.

3. The grinding mill makes an ideal agitator, and it is of decided advantage to add the oil ahead of the grinders.

4. The treatment of the mill sand tailing ground through 60 mesh should result in a tailing assaying not over 0.10 per cent. Cu. and a concentrate carrying not over 30 per cent. insoluble.

5. It is thought that the best density of pulp is from 25 to 30 per cent. solids.

6. Heating of the pulp to about 70 degrees F. seems to be of advantage, although there is a possibility that this heating may be dispensed with during the summer months without any injurious results.

7. Acid seems to be beneficial but it is not of as much importance as in the treatment of the slime.

Tests With Minerals Separation Machine of Sub-Aeration Type.

This machine was sent here by the Minerals Separation Co., and was set up and tested at its request.

The principal difference between this and the No. 1 machine is that air is introduced at the bottom of the agitator compartment. The agitator was of the Howard type, practically a "balanced" pump impeller run backward, and each shaft had two impellers, one placed above the other and separated by a stationary grid. There was also another grid above the top impeller. There were four agitator compartments and four spitzkasten. The agitators made 185 r.p.m. At first it was planned to suck air from the atmosphere by the action of the impellers. This did not work, however, and it was found necessary to force air into the cells under a few pounds pressure. The feed was introduced through the bottom of the first agitator cell. The laundering was arranged so that as many spitzkasten as desired could be sent to finished concentrate, the remainder going to middling and being returned to the machine. This machine required 47 h.p. under a full load of slime, including motor and belt-transmission loss.

Two tests were made, one treating round-table feed, and one treating round-table tailing. It may be possible to develop an efficient machine of this type, but the particular machine sent here for testing was certainly not satisfactory.

A later test was made in which the spitzkasten were dispensed with and the froth was taken directly off the top of the agitator cells. Under these conditions, the four agitators seemed to create too much disturbance for the proper removal of the froth, and only two agitators, the first and third were operated. These modifications did not improve the work of the machine. This modified machine was called No. 2A.

Tests With Callow Pneumatic Machine.

Tests made by Mr. Callow at his laboratory in Salt Lake on samples of our mill tailing ground through 40, 60 and 80 mesh, and of our slime, had given such promising results that it was decided to try out the Callow machine on a commercial scale. Accordingly, there was shipped here during September, 1914, five standard Callow cells, 2 by 8 feet, a Pachuca agitating tank and accessory apparatus, consisting of blower and sand pumps. This equipment was installed in the old 80-ton experimental leaching plant and was ready for operation the latter part of October.

In addition to the Pachuca agitator recommended by Mr. Callow, we built a set of two mechanical agitators. These agitators consisted of a tank about 10 feet long by 2½ feet wide and 2½ feet deep, in which revolved a horizontal shaft carrying a set of paddles. These agi-

tators were belt driven from one motor and required a total of 25 to 30 h.p., including motor, belt and counter-shaft power loss. The agitators seemed to work well and had a combined capacity of about 60 tons of slime per 24 hours.

From tests on treatment of round-table feed and tailing by these machines, we concluded:

1. On our slime, air agitation is not as satisfactory as mechanical.

2. The capacity of one standard Callow cell is about 15 to 20 tons of slime per day.

3. The Callow machine produces a clean concentrate, but does not give as clean a tailing as the Minerals Separation machine.

4. The Callow machine is more sensitive and requires closer attention than the Minerals Separation machine.

5. The cost of repairs would probably be less on the Callow machine than on the Minerals Separation machine. This cost, however, is comparatively small for either machine.

6. The power required per ton treated in the Callow system is just about the same as that required in the Minerals Separation machine.

In all of these tests the original feed was divided among the Callow rougher cells, operating in parallel. As a rule, there was one cleaner cell operating also. When this was operating the concentrate from the rougher cells went to it, the cleaner making a final concentrate and a middling which was returned to the system. The rougher cells made the final tailing.

From tests on treatment of mill tailing after grinding through 60 mesh we concluded:

Conclusion From Tests.

The conclusions drawn from the foregoing tests were that the Minerals Separation machine was best adapted for the flotation work at Anaconda. Furthermore, that the most efficient reagents would be sludge acid kerosene, wood creosote, and sulphuric acid.

Description of Remodeled Concentrator as Adapted to Flotation.

The concentrator at Anaconda, as remodeled for flotation, consists of eight sections, each of 2,000 tons per day capacity, giving a grand total of 15,000 tons per day, allowing for shutdowns, repairs, etc. All sections are alike with the exception of Section 1. In this section Hancock jigs are used in place of Evans jigs and tube-mills are used in place of Hardinge mills.

Milling Division.

The ore is fed from the bins to a 2-inch round-hole shaking screen, the oversize going to a 12 by 24-inch Blake crusher. The product from this crusher is delivered to a 2-inch round-hole trommel, the oversize of which is sent to two 8 by 20-inch Blake crushers. The product from these crushers, together with the undersize from the 2-inch screens, is elevated and passed through 1-inch round-hole trommels. The oversize from this is treated in coarse Harz jigs, making a middling and a concentrate; the undersize is passed through ¾-inch trommels, the oversize being treated in fine Harz jigs making a concentrate and a middling. All sections are alike up to this point. In Section 1, the undersize from the ¾-inch trommel is screened on 1½ by 12-mm. trommels, the undersize going to the Anaconda classifiers and the oversize to the Hancock jigs. The treatment of the products from this point is the same in all sections, except that Section 1 uses tube-mills in place of

Hardinge mills for grinding, as noted previously. The undersize from the $\frac{3}{8}$ -inch trommel is screened through 4-mm. trommels, the oversize from these going to the double compound Evans jigs and the undersize going to $1\frac{1}{2}$ by 12-mm. trommels. The undersize from these trommels goes to the Anaconda classifiers, the oversize to double compound Evans jigs. The two sets of Evans jigs make a concentrate which goes to the dewatering bins and a middling which is ground for further treatment.

The concentrate from the coarse Harz jigs is dewatered and conveyed to bins. The middling is screened on a dewatering screen, the undersize together with the hutch product from the coarse Harz jigs going to the Evans jigs. The oversize is passed through rolls, 54 by 24 inches, and thence back into the system ahead of the 1-inch round-hole trommels. The concentrate from the fine Harz jigs is sent to the bins. The middling is screened through a dewatering screen, the oversize going to 54 by 24-inch rolls and then back into the system ahead of the 1-inch round-hole trommels. The undersize of the dewatering screen together with the hutch discharge of the fine Harz jigs goes to the Evans jigs.

The concentrate from the Evans jigs is dewatered in bins to about 7 per cent. moisture, and sent to the smelter. The jig concentrate assays about 15 per cent. insoluble and 8 per cent. copper. The middling, together with the hutch product is dewatered in tanks and screened through $1\frac{1}{2}$ by 12-mm. trommels, the undersize from which goes to the Anaconda classifiers, the oversize through 54 by 24-inch rolls, and back to the $1\frac{1}{2}$ by 12-mm. trommels.

The spigot from the Anaconda classifier is treated on 18 Wilfley tables, fitted with Butchart riffing, making a concentrate and a middling. These tables make a concentrate assaying 25 per cent. insoluble and a middling assaying 0.9 per cent. Cu. The concentrate is sent to the dewatering bins, together with the fine jig concentrate, and the middling is sent to the 10 by 4-foot Hardinge mills. The overflow from the Anaconda classifiers is sent to the slime thickener division, consisting of 28 by 3-foot Dorr tanks. The spigot product from these tanks is divided; about one-half is returned to the section and the remainder is sent to the slime plant.

The product from the Hardinge mills is treated in six simplex Dorr classifiers—one classifier to each mill—the overflow going to the flotation division and the classifier sand being returned to the mill.

At the time it was first decided to remodel the concentrator, it was not definitely known whether pebbles or steel balls would be used for grinding. To provide for this uncertainty a compromise was effected. The mills were made 10 by 4 feet and built sufficiently strong for steel balls in case balls were used. Each mill was equipped with a 225 h.p. motor directly connected through a flexible coupling. The mill filled with pebbles takes from 95 to 115 h.p. to operate. In case steel balls were used it was planned to put in a false wood lining back of the steel lining in the cylindrical part of the mill to reduce the effective diameter of the mill.

This latter plan was finally adopted, and the Hardinge mills will be equipped with the false wood lining, 15 in. thick, in the cylindrical part of the mill, and a Cascade steel lining. With this form of lining, the mill is virtually 7 1-2 by 6 ft. and requires about 225 h.p. when loaded with steel balls.

The lining was designed by the American Manganes Steel Co. At first the pebbles, and later the balls, were fed to the mills through the feed scoop. This method of introducing the grinding medium into the mill gave considerable trouble, due to the breaking of the feed boxes caused by the jamming of a pebble or ball between the revolving scoop and the feed box. We tried to obviate this difficulty by various changes in the amount of clearance left between the scoop and the box, but without success. In our particular case this trouble was aggravated by the fact that we had to use 7 ft. diameter scoops, in order to lift back into the mill the sand discharged by the Dorr classifier. Finally a method was tried of feeding the pebbles, or balls through a spout passing through the centre of the feed scoop. This device has worked splendidly and all of our mills have since been equipped with it.

Flotation Division.

The flotation division consists of four Minerals Separation machines, each having 15 agitators 3 ft. square, and 14 spitzkasten or floating compartments. The agitators for the Minerals Separation machines are of gun metal and are driven by bevel gears from a line shaft, the direction of rotation of the agitators alternating.

The machines are made of California red wood; the agitator boxes are further lined with hard maple extending about 18 in. from the bottom of the box.

Each machine has an individual drive, power being supplied to the line shaft by a 150-h.p. motor running at 385 r.p.m. The speed of the agitators is 225 r.p.m. and as the impellers are 18 in. in diameter the peripheral speed is about 1,060 ft. per minute.

Each machine makes three products, a concentrate, which goes to the dewatering division, a middling which is returned to the head of the machine, and a tailing which goes to waste. The concentrate is taken from the first three to five spitzkastens and the middling from the last nine to eleven. A portion of the pulp is overflowed from the last three spitzkastens together with the froth. About 6 to 8 lb. of (50° Be H_2SO_4) per ton of flotation feed is used together with 2 to 3 lb. of kerosene sludge acid and 1-2 to 1 lb. of crude wood creosote. A portion of the wood creosote is added ahead of the Hardinge mill (about 0.03 to 0.05 lb. per ton of feed) and the remainder is added in the sixth agitating compartment. The sulphuric acid and sludge acid are added at the head of the machine. The pulp is heated to from 60 to 70 degrees F., by passing live steam into it at the head of the machine. Three machines are used for treating sand and the fourth for treating current slime from the upper portion of the mill. Each machine has a capacity of about 400 tons per day on sand and 175 tons on slime.

The method of adding the oil and acid is rather unique. The mechanism consists of a revolving disk to which are attached, around the circumference, a number of cups. This disk is set vertically so that its lower edge dips into a pan of acid or oil. As the cups come around they are filled and later discharge their contents into a suitable launder leading to the flotation machine. The disk is driven by the friction of a wheel against another disk attached to the main drive. The wheel is run at constant speed and by varying the point of contact between wheel and disk any speed desired can be given to the main disk and thus the amount of oil or acid added can be regulated. In addition to the speed regulation, the amount of oil or acid fed may be varied by adding or removing cups or by changing the size of the cups.

At present (December, 1915), seven sections are operating on the new flowsheet, and the whole mill will be remodeled not later than Jan. 15, 1916. The sections are being remodeled one at a time. All the work is being done by the company's engineering force. Things have been so well organized and systematized that it requires less than 30 days to tear out the old section and install the new equipment, ready for operation.

(To be continued.)

YUKON GOLD.

Attached to the Guggenheim Exploration Co. circular is a general statement regarding the position of the Yukon Gold and its outlook, prepared by O. B. Perry, general manager:

"Company now owns dredging and hydraulic mines located near Dawson, Yukon Territory; dredging properties in the Iditarod and Ruby districts in Alaska; and on the Feather River, Butte Creek and American River in California. It has also 11 dredges, with power plants and other equipment required for their operation; a 70-mile ditch system, and complete hydraulic plant.

"The company has for several years past adopted the policy of purchasing new properties to add to its holdings and to take the place of its older mines as they eventually become worked out. * * * Substantial holdings have been added to the properties originally acquired. During the last two years it has acquired gold dredging properties in Alaska and California, which it is estimated will yield over \$3,000,000 of net profits.

"Company is now indebted to the Guggenheim Exploration Co. in the sum of \$1,375,000, for advances made from time to time as funds have been required, for working capital, additional equipment, and other purposes. The Guggenheim Exploration Co. owns * * * properties adjacent to the holdings of this company, and it would be advisable that these claims and the equipment be purchased. This purchase can be made for \$893,000.

"If the present policy is to be continued and the properties are to be operated to the best advantage, it is necessary that the company shall have additional working capital with which to purchase and equip new properties, complete such equipment as is now under way, and for other corporate purposes. The amount required to take care of these present and future needs has, after careful consideration, been fixed at \$2,732,000. This sum, together with the present indebtedness to the Guggenheim Exploration Co., and the purchase price of the Gold Run property and equipment, will make the aggregate indebtedness of the company, including all of its floating debt, \$5,000,000. This indebtedness should be funded and it is now proposed that its payment be secured by the issuance of eight serial promissory notes covering a period of eight years.

"Disregarding future possibilities, the present holdings of the company are capable of yielding sufficient net profits in the next eight years to retire this indebtedness, and leave a surplus for dividend purposes. If the company is successful in acquiring additional properties, which it is intended to acquire with the working capital thus provided for it, the result will be an increase in the life of the company, in its earnings, and in yield to its stockholders."

BOSTON CREEK.

According to the "Northern Miner" all engineers who have visited Boston Creek are inclined to take its claims as a mining camp quite seriously. "It is true that there are but two good prospects developed, but these two are quite good. There is plenty of free gold; and the character of the ore deposits coupled with geological conditions are favorable for the development of veins sufficiently wide and of a grade high enough to mine at a handsome profit."

There are two prospects being worked at Boston Creek, one within three-quarters of a mile of the track, at Boston Creek, a station just established, 51 miles north of Cobalt, and the other three miles south of Pacaud Township.

The first and more important of these two prospects is the property of the R. A. P. Mining, Prospecting and Developing Company. The R. in the syndicate stands for Mr. E. M. Richardson, the A. for Mr. W. B. Albright, both of New York, and the P. for Mr. J. A. Papassimakos, who is also manager of the company's affairs at Boston Creek. There are two claims upon which work has been done by the R. A. P. Syndicate at Boston Creek.

The other working property is the Miller Independence, a Dayton company. This company purchased the McDonough veteran claim from Mr. Fred Connell and his partner, McDonough, and they have already completed all payments.

The company has been handicapped in their construction by the severe weather, the depth of snow and in the fall the difficulty of getting material over a bad road. Under the circumstances they have made excellent headway. The compressor should be running in three weeks time in the power house, good camps have been built and ground is now being broken for the erection of the Nissen stamp. There are about twenty men working under the direction of Mr. Adams, previously at the Dome staff.

GYGES PORCUPINE MINES, LTD.

Speaking of the La Palme, Three Nations merger, The Northern Miner says: "The name of the new company will be Gyges Porcupine Mines, Limited, not Dominion Porcupine. It will be capitalized at 2,000,000 shares of par value of \$1. 500,000 shares of the new company will go to the Three Nations Mining Co. and 400,000 to the La Palme, as reported. On the new directorate the Three Nations Mining Co. will be represented by one director and the La Palme by one director, while the remainder of the board will consist of men very well known in mining circles in Toronto. A sufficient quantity of treasury stock will be underwritten to pay off debts, which amount to about \$170,000, and provide working capital, and if there are no hitches in the program work will be commenced as soon as weather conditions permit of the efficient overhauling of the surface plant, which has now been lying idle for some time.

LA ROSE IN DELORO.

Work has been begun on the Maidens McDonald claims in Deloro Township by the La Rose Mining Company, Mr. G. C. Bateman of Toronto having taken an option on the property for the La Rose.

A SUDBURY ORE CHUTE

By Albert E. Hall.

Some time ago experiments were carried on with various types of chutes and chute gates to determine which was the most satisfactory for use with the heavy nickel belt ores. Types of gates that were being used successfully in other important mining camps were tried out at the various mines. For example the finger chute gate that works so successfully in some mines when installed in the nickel district proved to be a failure. Both air operated and hand operated gates were experimented with and the bottom of the chutes were tried at various slopes. The

material spilling out on the track. This was due to the fact that the cross timber did not fit tight against the bottom of the chute. This difficulty was easily remedied by placing two angle irons on the chute lip and putting a board across fitted against the chute bottom.

A more serious difficulty then arose however. It was found that when the bottom of the chute was made steep enough to make the material slide easily, that when the car was loaded and the timber dropped to stop the flow of muck that the muck would continue to flow sometimes and bury the car on the track or at least cause some incon-

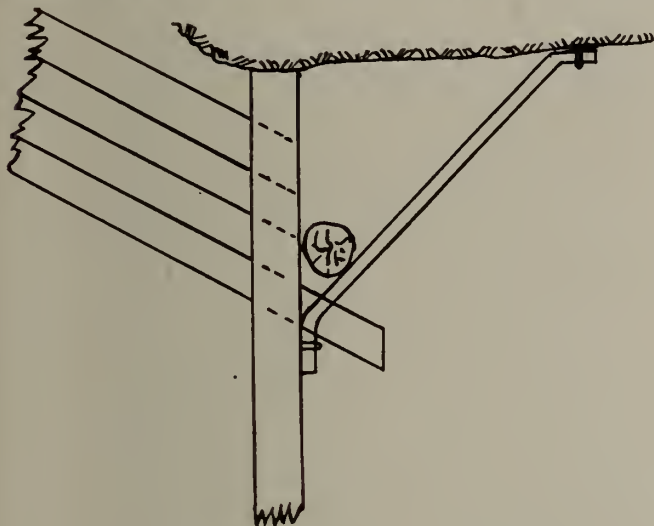


Fig. 1—Side view of front part of chute as originally designed.

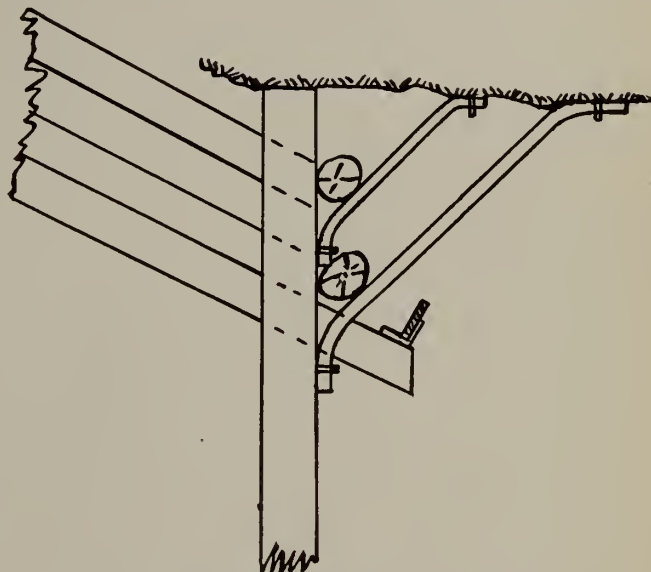


Fig. 3—Chute with double set of rails.

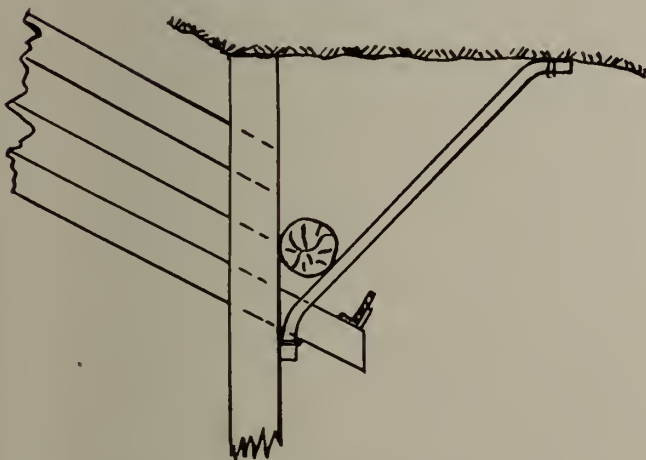


Fig. 2—Chute with board to prevent spillage of fine material.

type of chute that was finally selected as being the most satisfactory was what is known locally as the Minnesota chute. This gate consists of two irons, usually 25 lb. rails, inclined at 45 degrees with the posts of the chute. Across these two rails a timber is placed which closes the front of the chute. The whole arrangement was fully described in the *Engineering & Mining Journal* some time ago. It was not long however before improvements began to suggest themselves and these as yet have not been described.

The Minnesota chute had not long been in use when it was found that considerable trouble was caused by fine

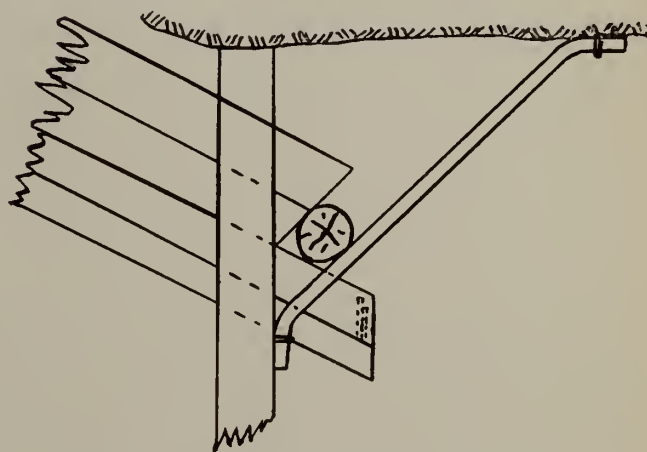


Fig. 4—Chute with side timbers lengthened.

venience. There was also danger of the trammers being injured. It was impossible to block the top of the chute up as the muck is broken by the machines into large pieces and there must be enough room at the chute mouth to allow these to pass into the car. A second set of irons was therefore placed above the original gate and a timber placed across these. This device proved most effective. It both protected the trammers working on the chute from the top and stopped the muck from flowing over the lower timber when the car was full and the lower timber had been dropped. On the other hand since it was possible to raise the upper timber big pieces could be negotiated alright.

The construction of the chute was changed as follows to try to improve it in some respects. Only a few chutes of this construction have been tried so that it cannot be said just how successful they will be but they appear to work very well. The bottom timber on each side of the chute was continued out to the lip edge instead of being cut off flush with the post as had been done. The idea of this was to stop fine material from coming off the lip at its side and falling on the track. The rest of the side timbers were also lengthened being continued out so that their ends formed a line parallel to the gate irons but leaving enough room between the irons and the side timbers to allow the chute timber to be operated. This idea prevents any pieces from coming over the sides of the chute and thus protects the trammers. It does not however, permit of an extra set of rails being put on the chute.

PROFIT-SHARING.

New York, Feb. 18th.

Charles M. Schwab, speaking to magazine publishers at Aldine Club, New York, Wednesday, said:

"Brains are a bigger asset than money. They are essential to success of any business and should be paid for by the corporations who profit by them."

Mr. Schwab said that he had paid Vice-Pres. Arch Johnson of Bethlehem Steel Co. \$600,000 in addition to his salary last year, and that another assistant had received more than \$1,000,000 as his share of profits he had produced. He continued:

"I am a believer in profit-sharing with department heads and with workmen who by their personal efforts add to profits of an enterprise either by economies or by increased output. It has been the gratification of my life that I have been able to make money for young men by bringing out their latent possibilities."

"I was once severely criticized by a stockholder for having distributed 15 per cent. or 20 per cent. to managers of departments before we had paid dividends. This stockholder characterized it as useless extravagance. I asked him whom he considered the most successful profit producer."

"Andrew Carnegie," he answered.

"Exactly," I replied. "Well, he gave 50 per cent. of his profits, and I can speak authoritatively on this, because I shared in some of them."

"Profit-sharing will settle the labor problem eventually. It will be a survival of the fittest; the producer will be rewarded, while the non-producer will remain where he is."

"Big business has eliminated small business. There is no hope for success of any business unless highly specialized. The small business cannot exist, for big business by economies has made it impossible. The employee will supplant in earning capacity the small business man. Thus by his own efforts, without capital, he will secure the competency for which we all strive."

As an instance of specialization of business, Mr. Schwab told of having spent \$10,000,000 in development of the South American ore mines, without having moved a ton of ore. He is now building ten ore ships of more than 17,000 tons each.

England and Germany, he declared, had stood still in production of steel, while the output of the United States during the last year was 24,000,000 tons.

"I expect to see this output increased to more than 40,000,000 tons in 1916," Mr. Schwab said. "In 1901 I built the first steel railroad car and now more than 5,000,000 tons of steel are going into construction of these cars."

He was called on to tell the "Bob" story when he was manager of one of the Carnegie plants.

"A Carnegie manager was a mighty big man in any town he was in," Mr. Schwab assured his hearers. "He was a bigger man than most of you would believe. I was riding in the carriage with 'Bob' the negro driver, one day, and as we passed a woman and a little child were standing by the road."

"There goes Mr. Schwab," the woman said to the child. I was impressed that she too knew what a big man I was. But the child soon put my feet back on the ground. Turning to her mother she inquired, 'Which one, mamma?'"

Mr. Schwab said he had been offered fabulous sums for Bethlehem plant—sums he had never dreamed of. He said he talked the matter over with his wife and asked her if he should take the offer.

"Half of it is yours," he said he told her.

"There are two reasons why you should not accept," he said Mrs. Schwab told him. "The first is, what could I do with the money, and the second is, what would you do without your work?"

Mr. Schwab said his greatest joy in life was in knowing that he was creating something that would add to the country's commercial wealth and furnish an incentive and opportunity for the young men of brains in the country.

"Any man who is not interested in his work," Mr. Schwab said in concluding, "should give it up. The aristocracy of this or any other country should be the men who have succeeded, the men who have achieved and the men who have aided in the upbuilding of the country."

He said that the Bethlehem plant could, in the event of war, turn out for this country 50 per cent. more guns and ammunition than the Krupp works in Germany.

IN DELORO AND ROBB.

Porcupine, Feb. 19.—There are now two shifts working at the Maiden-MacDonald claims in Deloro. Mr. George Sweet took two men in with him to his claims in Robb yesterday to uncover some test pits for a New York Syndicate to examine. The camps at the Kilroy Hamilton claims in Deloro in charge of Mr. E. P. Monteg of Toronto are finished and a gang of men went this week to start mining development.

The new shaft on the Jamieson claims in Robb is down twenty feet.

The Empire State Mines Limited has been incorporated to operate the property previously operated by the Deloro Limited.

The Rand Syndicate operating in Deloro Township has decided to install a steam plant, as the result of the work done by hand has been so encouraging. A contract for 5,000 feet of diamond drilling on the Chisholm Vet was made this week.—Porcupine Herald.

BOSTON CREEK MINING CO.

A new company has been incorporated with a share capital of \$2,000,000, under the name of the Boston Creek Mining Co., to develop some claims in that section, says The Cobalt Nugget. This will be the second mining company formed to develop Boston Creek claims. The other one is the Miller-Independence. The R. A. P. Syndicate is operating, and the work on the latter property is farther advanced than on any other property in the district.

THE SLOCAN DISTRICT, BRITISH COLUMBIA, IN 1915

By E. Jacobs

(Continued from last issue.)

The zinc-concentrating mill at Rosebery was erected about eight or nine years ago by the owners of the Monitor and Ajax mines primarily for treatment of ores from those properties, but also with the expectation of doing business as a custom plant for concentrating lead-zinc ores of Slocan district. It was operated for a short time and then closed, and had remained unused until, after the destruction of the Ivanhoe mill at Sandon, of which he had been lessee, Mr. J. P. Keane arranged to continue in the Rosebery mill the custom concentrating business he had established at Sandon. The chief change made in the mill plant by Mr. Keane was the substitution of Wilfley tables for the Luhrig vanners included in the original equipment of the mill. Under the new auspices the first car of concentrate made was loaded and billed out on October 30, 1915. The product was from Lucky Jim ore; it contained 42 per cent. zinc. The shipment was consigned to the zinc smelting works at Kenosha, Kansas, U.S.A.

Near New Denver—During 1915 work was continued on the Capella; a little ore was taken out from the Molly Hughes and shipped to Trail; two men worked on the Fairy Queen, a promising prospect on Trout Creek, on the west side and near the head of Slocan Lake; six men were employed at the Apex, in Denver canyon, at which the lower tunnel is in 450 ft. and a raise connects with the upper tunnel 235 ft. above where quartz containing silver and gold was being extracted in the latter part of the year; tunnel-driving was continued on the Marion; a contract was let for driving 150 ft. in No. 2 crosscut adit of the Hartney, and leasers took out a little ore from the California.

Silverton and Four-Mile Creek—Milling operations were resumed by the Standard Silver-Lead Mining Co. about the middle of 1915 after a suspension of production since August, 1914. By the end of 1915, there had been shipped to Trail 7,910 tons of silver-lead ore and concentrate containing 8,481,000 lb. of lead and 747,000 oz. of silver, and to the United States 4,406 tons of zinc concentrate containing 3,789,000 lb. of zinc and 102,000 oz. of silver. About 6,000 ft. of development work was done, of which less than 2,000 ft. was drifting and crosscutting in the Alpha mine, situated at a higher elevation than the original Standard mine. No important body of ore has yet been found in the Alpha by the Standard Co. Of the older levels of the Standard—Nos. 3, 4, and 5—most development work in 1915 was done on No. 4, which was extended, crosscuts were driven from it, and raises made. Work done on Nos. 5 and 6 was drifting, crosscutting, and raising. Most of the large quantity of ore taken from the mine during the several years of its biggest production was mined above No. 6 level. Not less than 1,600 ft. of work was done on and from No. 7, this consisting of drifting and crosscutting about 500 ft. and as much raising. Ore was found in a raise and it was drifted on between 100 and 200 ft., while an intermediate level between Nos. 7 and 6 was driven in ore for at least 100 ft., and stopes were opened from it. The ore at both east and west extremities of this shoot was zincy, but the heart of it gave much silver-lead ore. Work was stopped in No. 8 level at the beginning of February and it was not until September that the miners were put back into this lowest level of the mine;

the adit was extended and both crosscutting and raising was done, the raise going up in ore, of which there was not more than three feet in its widest part. In January, however, it was reported that a much better shoot of ore had been encountered on this level, but no particulars have been received. At the company's concentrating mill, which was operated continuously during the latter half of the year with excellent results as regards concentration of ore, a small experimental flotation plant was put in with the object of making tests in the direction of a higher saving of the zinc in the ore. Dividends were paid by the Standard company during the last four months of the calendar year, the total amount distributed during that period having been \$250,000.

Very little information has been obtained relative to the **Hewitt-Lorna Doone** group of the Silverton Mines, Ltd., or the company's concentrating mill situated on Four-Mile Creek, several miles up the creek from Silverton. The total of silver-lead concentrate received at Trail in 1915 from this property was 641 tons. The zinc concentrate shipped contained 1,386,000 lb. of zinc. No. 8 level of the mine was in 1,800 ft. in October, this level giving a depth of 1,200 ft. An extensive area of ground in which there is known to be a large quantity of high-grade ore, has been opened by the later development of this property, there being shipping ore of good quality down to the lowest level yet opened in the mine. A flotation process has been successfully used in connection with the concentration of the Hewitt-Lorna Doone ores, but particulars have not yet been made public.

Work at the **Lucky Thought** in 1915 was chiefly in No. 3 adit and raising to the level above. A road was constructed up the mountain almost to the entrance of the mine. Silver-lead ore shipped to Trail totalled 101 tons. The property is being explored by the Consolidated Mining and Smelting Co. under option of purchase. On the opposite range of mountains, situated 800 ft. higher up than the Alpha workings, the Echo had much exploratory work done on it during 1915. A big vein, stated to be fully 100 ft. in width, extends from the Standard through the Alpha and Echo and, it is claimed, on over the divide to the Idaho-Alamo properties. When visited at the beginning of November, a lower tunnel was in 500 ft. and an upper one 100 ft. The vein filling was chiefly a black graphite rock in which ore was found to occur in bunches, but no considerable body of ore has been encountered up to the time just mentioned. Quite lately a report was published that a nice shoot of ore had been opened, but nothing definite has yet been ascertained as to this. Fourteen tons of ore was shipped from the Buffalo, and 32 tons from the Wakefield, the latter well-known old mine has been acquired by local men, who took out a car of ore early in the autumn. The Comstock, back near the headwaters of Four-Mile Creek, was worked by leasers who shipped a small lot of ore which did not reach Trail until January. South-east of Silverton there is the L. H., which, since the B. C. Copper Co. relinquished its working bond on it, has been further developed by its owners.

The Galena Farm Group of five Crown-granted claims, situated a mile and a half south-east of Silver-

ton, which had been idle for a number of years until the late Patrick Clark arranged to work it under option of purchase, was one of the mines in this part of the Slocan at which there was much activity during 1915. A crosscut adit driven 800 ft. cut the vein at 75 ft. below the old 100-ft. level and drifting on the vein was in progress in the last few months of the year. A raise has been made from the lowest to the 100-ft. level and thence to the surface to get under the old dump stated to contain about 3,000 tons of ore which it is intended to convey to the concentrating mill through the new raise and lower tunnel. The 100-ft. level, driven on the vein for 350 ft., shows the average width of the vein to be about 7 ft., all milling ore. The plan of working under consideration last October included stoping ore from the 100-ft. level to the surface and extending the lower drift as well. Later, the ore will be followed down, and if conditions shall be found to warrant such an undertaking, a crosscut adit will be driven between 4,000 and 5,000 ft. to get under the present workings at 600 ft. greater depth. Improvements made on the surface in 1915 comprise erection of a number of new buildings, repair of old boarding and other houses, construction of about one mile of waggon road to provide an easier grade for hauling to and from Silverton than that of the old road, repair of dam and putting in a new 12-in. pipe-line about 2,000 ft., also an 8-in. line of similar length to utilize, for running the dynamo, the overflow water from the compressor. The new concentrating mill machinery and plant include crushers, sorting belt, classifiers, trommels, jigs of Hartz type, etc. Middling is reground in a Huntington mill, elevated and trommelled; coarser size is sent to a moveable screen jig; smaller size to hydraulic classifier and thence to Wilfley tables, of which there are ten, making two products, namely, silver-lead and zinc concentrates.

Slocan City Mining Division.

The output of ore from mines in Slocan City division was even smaller in 1915 than in 1914—only 234 tons as compared with 505. Ore receipts at Trail in 1915 from this part of the district were as follows: From the Alice, 16 tons; Black Prince, 22 tons; Enterprise, 138 tons; Hamilton, 19 tons; McNeish, 4 tons, and Ottawa, 35 tons. The Eastmont, which in 1914 shipped 152 tons, was not on the 1915 shipping list; the Ottawa's comparatively large output of 280 tons in 1914 was also lacking in 1915. These losses in output notwithstanding, the outlook for the division at the end of 1915 was believed to be more promising than a year earlier, for there was activity on several properties which had been sent supplies for a full winter-season's needs.

The Ottawa, situated about five miles from Slocan City, had been a productive mine prior to the several years of inactivity that preceded its passing to the possession of the Consolidated Mining and Smelting Co., which acquired it in 1913 and has since developed in it some shoots of high-grade ore. Work was suspended in the autumn of 1914, shortly after the outbreak of war in Europe, but was resumed in 1915, though there has been little ore-production since. Development is being continued. The Alice S, on Springer Creek, was worked in 1915 by its owners, a New Jersey, U.S.A., company. A crosscut was driven 110 ft. to the vein and development was continued by drifting both ways, altogether about 500 ft. on the vein, and a raise was made 70 ft. to the surface. Sixteen tons of ore taken out in the course of development, was ship-

ped to Trail to ascertain its value in bulk. Another crosscut was commenced at a vertical depth of 90 ft. below the upper one, with an estimated distance of 248 ft. to be driven to reach the vein. Buildings erected include houses for the accommodation of the men employed—eight were working last season—and an ore-house. A mile and a half of waggon road was made to connect with the Slocan City-Springer Creek road.

Adjoining the Alice S is the Black Prince, which Mr. J. T. Tipping is working under lease and bond; the property is on the divide between Springer and Lemon Creeks.

Development was commenced in June, and in November there was shipped to Trail a car of dry ore estimated to average 800 oz. silver a ton, 6 per cent. lead, and 22 per cent. zinc. The work done included driving the lower tunnel to cut the vein at 125 ft. deeper than the old workings; for 50 ft. a drift was in ore. When crosscutting in old workings from No. 3 a shoot of high-grade ore was encountered and men were put on stoping. A raise was made 60 ft. from No. 3 and it was intended to continue raising if the ore should be found sufficient to warrant this further development. Mr. Tipping also drove a tunnel on his own claim, the Gordon, adjoining the Black Prince.

Barber and Taylor worked on the Meteor under lease, and took out some ore of good grade; they got in supplies to allow of continuing work throughout the winter. Wafer and Johnson found ore on the Gladys, on which they had been working a year or more. Geo. Long had three men working on the Lily B; a crosscut was driven to the vein and ore was mined, with prospects sufficiently good to induce the getting in of supplies for continuing work all through the winter.

No information was obtained concerning the Enterprise on Ten-Mile Creek, except that 138 tons of ore was shipped to Trail, as compared with 50 tons in 1914. There were other properties worked in Slocan City division, relative to which particulars were not received, but generally there was expectation that more mining will be done in the division in 1916 than in any of several recent years.

ONTARIO MINING ASSOCIATION.

Last week several directors of mining companies operating at Cobalt and Porcupine met in Toronto to discuss the proposed tax on profits. It was decided that a deputation should be sent to interview Sir Thos. White at Ottawa. Col. A. M. Hay was appointed to head this deputation, the other members of which he will name. Col. R. W. Leonard will be one of the members to accompany Col. Hay.

The meetings were well attended. Among those present were: D. A. Dunlap, Alex. Fasken, W. E. Segsworth, F. C. Culver, J. C. Watson, W. R. P. Parker, Z. Gallagher, A. J. Young, A. M. Hay and R. W. Leonard.

CANADIAN MINING INSTITUTE.

A meeting of the Toronto branch of the Canadian Mining Institute was held in Toronto Saturday, Feb. 26, to discuss the proposed tax on profits. There was a large attendance, and it was the unanimous opinion that the proposed tax would be unfair and unwise. The subject will be brought up at the Ottawa meeting this week.

FLOTATION PROCESSES*

By C. Terry Durell.

Thirty years ago Carrie J. Everson of Chicago described flotation as well as it can be described to-day as follows: "The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral, or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means. The stirring or incorporation of the ore with the liquid should of course be thorough for the purpose of bringing the mineral into contact with the oil and acid as completely as possible. I do not, therefore, restrict myself to any particular proportions of the substances employed. The non-metallic matter is afterwards separated from the metal or mineral by the peculiar action of the acid or soluble neutral or acid salt operating in the presence of water to detach the gangue from the mass." In this patent (No. 348,157), she gives a list of minerals she successfully saved by this process. These include native metals, sulphides, antimonides, arsenides, tellurides and some carbonates and oxides. She used various common oils and fats as well as the common acids. She operated the process with various salts such as sulphates and chlorides of sodium, zinc, copper and double sulphates of potassium and aluminum. Mr. Ben S. Revett in M. & S. Press of Oct. 16, 1915, says, in speaking of this process: "I saw practically one of the first demonstrations." This was in 1889 at Sparta, near Baker City, Oregon. Speaking of Criley he says: "He kept stirring and stirring until the bubbles floated to the surface of the water and acid."

It is quite evident from this description that thirty years ago a test might have been made for any of the many present-day processes using oil.

Seldom has litigation so retarded a science by smothering it in a cloud of secrecy. It is to be regretted that this condition has been brought about by some prominent engineers attempting to gain a world-wide control of all processes of flotation after the basic patents had expired.

The essential elements of flotation can be arrived at in two ways: (1) Investigation of conditions under which different minerals float; and (2) investigation of all different processes. In Australia, the home of flotation, more flotation experiments have been carried out than in any other country.

Kenneth A. Mickle's experiments published in the Proceedings of the Royal Society of Victoria¹ furnish the most complete record of systematic research to learn the reasons for flotation. These experiments were carried on with different metals and minerals in the laboratory and subject to the conditions met with in the several flotation processes. He tried them with

water, oil, acid and alkali; hot and cold; at atmospheric and reduced pressure and in various combinations. Many of his experiments I have confirmed at the Colorado School of Mines. His experiments show that minerals at the surface or in the interior of liquids float or tend to float due to: (1) Liberation of gas contained in the liquid either by reduction of pressure or heat; (2) generation of gas in the liquid by means of acid, or (3) supersaturation of the liquid with gas.

He shows that minerals absorb (occlude) gas to a degree not previously suspected and that the effect of this occluded gas is that: (1) Particles are not wholly wetted by immersion in water; (2) particles tend to float when sprinkled on a liquid surface; (3) particles collect bubbles when heat or vacuum is applied, and (4) particles collect bubbles evolved from a gas saturated solution.

The Swinburne and Rudorf² experiments show that "it seems necessary that the gas should be produced at the surface of the particles themselves." Many other references might be cited to show that the whole subject of flotation depends upon gas occlusion by the minerals to be floated.

As was to have been expected, Mickle showed the gas held by flotation concentrates consists almost entirely of nitrogen, oxygen, and carbon dioxide. That is to say, the occluded gas was from the atmosphere.

These experiments have thus eliminated oil, acid, alkali, heat, vacuum, saturated gas solutions and the like as being essential elements of flotation. The conclusion that necessarily follows is that flotation depends on the fact that, **due to the occluded gas of the mineral particles, they become entangled or caught by the surface film of:** (1) the free surface of the liquid; or (2) the surface of a gas bubble; (a) above the surface or (b) under the surface.

It is well now to classify and investigate the different processes to see if a similar system of elimination will give the same results as this obtained from laboratory experiments.

Surface Tension Flotation.

One of the best known types of flotation is that which the prospector, in panning, tries to guard against. How easy it is to drain the water from the trail of fine gold in the pan and then pick it up on the surface of the water. Every vanner-man can testify as to the richness of concentrate from the settling boxes back under the machine behind the main concentrate box. This is the concentrate that dries as the belt travels down over the end of the vanner and floats on the surface as the belt dips into the water in the concentrate box. Hezekiah Bradford in his patent No. 345,951, in 1885, reverses this process by using a belt to remove the floating concentrate. It was nearly twenty years later (1904) that Macquisten used a spiral in a tube to lift and expose the pulp to the air so the metallic particles would float on the surface of the water in the tube. This was a commercial success

*Extract from an article published in the Colorado School of Mines Magazine, Feb., 1916.

¹Vol. 23 and 24, Part 2, 1911. Abstracted in Eng. and Min. Jour., Aug. 12, 1911 and July 13, 1912.

²Faraday Society paper read Dec. 12, 1905. Abstracted Eng. and Min. Jour., Feb. 10, 1906.

though oil is now used to aid the process. Henry E. Wood's machine, patented March 21, 1911 (No. 987,209), feeds dry ore gently onto the surface of water so that the metallic particles float over a lip and are saved. All of these cases come under what may be termed **SURFACE TENSION FLOTATION**. Evidently the only essential feature is that the particles to be floated be exposed to air. That is, there must be a chance for gas occlusion. The selective action, which causes the metallic particles to float while the gangue particles sink, will be taken up later.

Bulk Oil Flotation.

How "the virgins drew up gold by means of feathers daubed in pitch" is told by Herodotus. Thus that pitch, oil, grease and the like adhere to metallic particles with greater force than does water has long been known. This fact was first recognized in a patent (No. 488, British) to William Haynes in 1860. Under the Elmore patents of 1898 and 1901, bulk oil flotation was put on a commercial basis, although the many plants built in different parts of the world were doomed to failure because of the great quantities of oil necessary. Excessive oil is necessary, due to the little difference in specific gravity between oil and water as compared to the greater difference in specific gravity between water and the metallic concentrate. As no acid was at first used by the Elmore process, it is not an essential element to flotation.

The Cattermole patent in 1903 improves upon this by using less oil in what was known as the oil granule process. These granules were then removed in various ways either from the bottom of the container or driven to the surface by an upward current of water or gas. This was the forerunner of the present froth processes, but the only plant built was a complete failure. This was to treat 400 tons daily at the Central Mine, Australia. Everyone who has made a froth flotation test has, probably, at some time, added too much oil and seen these granules resting above the pulp at the bottom of the vessel. Some may rise to the surface of the liquid and drop back again. In the Cattermole process, soap and acid were used, but a test, as above, shows that granules will form with oil only, so these two things are not essential elements. The only bulk oil flotation plant that I examined was at the Lake View Mine, Kalgoorlie, Australia. It, like all others, was a failure and I was not able to determine if gas occlusion by the metallic particles is the essential element to the process. From the very nature of the process, oil of course is an essential element. Mickle's experiments showed that mineral particles deprived of occluded gas do not, as a rule, become coated with oil in the presence of water. The selective action necessary for this flotation will be taken up later.

Froth Flotation.

In taking up these processes in detail to eliminate all but essential elements to flotation, such questions as air froth or oil froth, selective or preferential flotation, and the like will not be discussed. These things as well as the forces adhesion, electric, cohesion, surface tension, etc., will be taken up under other headings later. About four years ago I made a trip to Australia and studied these processes quite carefully at the largest plants then in the world working four distinctly different methods. Since then I have seen several plants operating in the United States but with only one different method or machine—the Callow.

Delprat Type.—The Delprat and Potter processes were developed independently at the same time, patented in 1902, and are practically the same. This was the first commercially successful froth flotation. It has since proved unfortunate for the Minerals Separation Co. that the Fromont patent in the same year was only taken out in Italy and England. For this reason it was necessarily suppressed by the purchasers. Also processes where gas is generated by electrolysis like the Fields come under this heading.

As G. D. Delprat was general manager of the Proprietary Company at Broken Hill, his process was naturally used there. About 1,000 tons were being treated daily when I studied the flotation process at this property. A "push feeder" delivered 700 pounds ore per minute to a single spitzkasten where flotation took place without agitation except that of the upward current of hot acid solution being added at the bottom. By heating the solution with superheated steam, it was intended to work with a solution as near 80 degrees C., the critical temperature for flotation, as possible. The working solution temperature, however, was below 70 degrees C. The quick action and simplicity of the process was most pronounced. A marketable zinc concentrate was being produced with high recovery without retreating it or the tailing. The essential elements may be summed up as follows: gas, acid and heat in addition to the ore and water. The acid attacking the carbonates in the ore produced the bubbles in addition to the selective action which will be discussed under a separate heading. This gas made the bubbles for the froth, as no air was taken into the solution in any way except the little that might come in with the ore. None could come in with the solution as no jet or nozzle was used above the surface of the liquid, which would have carried air in, as will afterwards be described. This solution was brought in at the bottom of the spitzkasten and, being hot, could contain but little dissolved air. Since heat was necessary, its only function was to expel occluded air from the mineral particles the same as from liquid in accordance with the law of Henry.

Vacuum Type.—The Elmore vacuum machines were being used at the Broken Hill, British plant, although they had been thrown out from several other plants there. This was not due to unsuccessful operation but to litigation. No more than the following essential elements are necessary for the operation of the Elmore, the only successful vacuum process: vacuum (to liberate the air to form bubbles), acid, oil and alkali. Cast iron machines are used and so lime is required to neutralize the pulp before it goes to the vacuum machines. The acid of course is not to generate bubbles, as in the Delprat process, but it creates the selective action. In accordance with Henry's law, gas or air is liberated from the pulp by reduction of pressure to form the froth. As will be shown later, these bubbles must necessarily form on mineral particles as nuclei. The bubbles burst very readily in the Delprat process, but there is such an ebullition that any metallic particles thus dropped are caught by the bubbles below. There is no chance for this with the Elmore, so the bubbles must necessarily be more persistent. In the Delprat, the bubbles are armored with the metallic particles. To make them more persistent in the Elmore, oil, in addition to the metallic particles, is used to coat them. This toughening of the froth with oil will be taken up under a separate heading.

Mineral Separation Type.—Under this heading may be grouped all processes or machines using rapidly re-

volving paddles or stirrers to beat air into the solution. This method of forcing air into solution beyond the point of saturation was known long before our grandmothers used it to beat eggs or whip cream. It matters not whether air be beaten by being admitted to the suction of a centrifugal pump or to the periphery under pressure or beaten in by the propeller on the vertical shaft of a mineral separation or other machine. The essential elements can be enumerated as follows: air (beaten in to supersaturation), acid, oil and heat. What is the difference whether bubbles be formed from air coming out from a supersaturated solution or from a solution subjected to vacuum? Bubbles will form on mineral particles as nuclei in either case. The acid here, of course, acts as in the former case. Since heat is not always used, its only function can be to assist in expelling the air from the mineral particles. The froth from these machines is the most persistent. This is due to the greater amount of slime and the better agitation to oil-coat the metallic particles. Like butter in a churn, these fine metallic particles are coagulated by the violent agitation. The mineral particles are so well oiled that an exceedingly coherent armor for the bubbles is produced. The oil films of these bubbles are extremely thin like those of other processes. Iridescent colors indicate this. The surface tension effect of the oil is added to that of the water for further toughening the bubbles.

The DeBavay Process.—This appears to be a purely surface tension process. As originally patented by DeBavay, it probably was, but, as now used by the Amalgamated Zinc, Ltd., of Broken Hill, it even has the bubbles although all the large ones are liberated before flotation commences. The same principles apply here as in any froth flotation. The clean sand is thoroughly agitated in an acid solution, washed and then again agitated in steel tanks with water to which a fixed amount of an oil mixture (mostly kerosene) has been added. The agitators in these tanks are like ship propellers and as large. This gives thorough oiling to the particles. A montejus delivers the pulp to the top series of four each DeBavay cones. The pulp is, therefore, surcharged with air due to this air pressure, since the air dissolved by the water varies directly as the pressure. Norris has patented (No. 864,856) the idea of thus surcharging a liquid with gas, but he delivers the surcharged liquid beneath the surface of the pulp mixture. The Callow machine also uses this principle except that the air pressure is exerted on the bottom of the liquid instead of on the top as with a montejus. There are no bubbles or froth because the pulp mixture from the montejus is turned on to the apex of the cones and spreads out, flowing down the steeply inclined surfaces. The essential elements to this process are: gas (in the form of air), acid and oil. These are the same as with preceding processes. Although there is no froth, air is here the prime requisite while the acid creates the selective action. The metallic particles are so well oiled they are not easily wetted by the water while their air films and minute attached bubbles bodily lift them to the surface of the water if, by chance, they go in under instead of on the surface when they strike the water at the periphery of the cones. In a laboratory test, the metallic particles seem to jump from the bottom of a beaker to the surface of the liquid.

Callow Type.—This includes all froth flotation processes depending on the supersaturation of the liquid by air pressure in accordance with the law of Henry. The DeBavay process was taken up previous to this as

it is the connecting link between this and Minerals Separation type. It (DeBavay) uses violent agitation which beats in air and also direct air pressure which supersaturates the pulp mass.

This supersaturation is caused, according to the Norris patent, by subjecting the liquid to an air pressure of several atmospheres. In the Callow machine, it is "a hydraulic pressure varying from 15 to 40 inches" that causes the liquid at the bottom of the box to absorb air beyond the saturation point of the surface liquid at atmospheric pressure. If too much air is blown into a Callow machine, the effect is the same as the air in the pachuca tank—agitation.

The bubbles composing the froth are derived from that air which was first absorbed and afterwards liberated on a mineral particle as a nucleus in the same way that air, beaten into solution in a Minerals Separation machine, supersaturates the liquid and comes out in the form of bubbles. A jet of air turned into liquid pulp produces bubbles which effect no mineral attachment. They pass through the pulp as do those from excess air in the Callow cell. The essential elements for the Callow type may be picked out as follows: air (from supersaturation of the liquid), oil and acid or alkali. The oil, as shown above, aids in making a more persistent froth. It is mixed with the pulp previous to entering the machine. The acid or alkali is to form an electrolyte for selective action.

Liquid Jet Type.—Heretofore only two ways of getting air into solution have been taken advantage of to aid flotation. These, as mentioned above, are: (1) beating it in as is done in Minerals Separation type; and (2) surcharging the liquid with gas as is done in the Callow type. While experimenting at the Colorado School of Mines some three years ago, I developed a third way which is now being patented. One of the patents has been issued.

Common occurrences of this phenomenon are seen everywhere. On drawing water into a beaker, bubbles form and rise to the surface. Where does the air come from? A muddy overflow is caused in a settling tank by allowing the mill stream to be turned down into the tank from some little distance above. Froth forms and overflows. Hydraulic air compressors and blowers are operated on this principle by turning a stream of water down a shaft or pipe. In the same way that an air film surrounds a drop of liquid so that the drop method may be used in determination of surface tension, so does an air cylinder enclose a liquid jet. This adhesion is so great that air is carried into the liquid to the supersaturation point and it comes out in the form of bubbles.

The model I built at the Colorado School of Mines treated ore at the rate of twenty-five pounds an hour working in an acid solution with oil fed to the first cone. This type of machine produces either a scum float like DeBavay's or a thick persistent froth with well armored bubbles. The essential elements may be noted as follows: air (brought in by the liquid jets), oil and acid, or alkali.

Essentials in Flotation.—Having classified flotation into that of (1) Surface Tension, (2) Bulk Oil and (3) Froth and subdivided Froth Flotation into the different types of (a) Delprat, (b) Vacuum, (c) Minerals Separation, (d) Callow, and (e) Liquid Jet, there are found only these few essential elements as follows: air or other gas, acid, heat, vacuum, oil and alkali. These only are necessary in addition to the liquid and the ore. It is possible to still further eliminate.

(To be continued.)

ONTARIO NICKEL MINES*

By Thomas W. Gibson, Deputy
Minister of Mines.

The nickel mines of the Province of Ontario are situated in the district of Sudbury, and are of great extent and value. The ore is a pyrrhotite, carrying the nickel mineral pentlandite and also chalcopyrite. In contents it varies from 1.5 to 5 per cent. in both nickel and copper, but the latter metal is usually somewhat lower in proportion than the former. A fair average of the ores as raised would be, say, 3.5 per cent. nickel and 2 per cent. copper. The deposits occur in lenticular masses on the outer edges of a huge laccolithic sheet of eruptive rock, which surrounds an elliptical area about 35 miles long and 17 miles wide. The first discoveries were made during the construction of the Canadian Pacific Railway, in 1883. The finders shipped a quantity of the copper ore to a refining plant in the United States. Unexpected difficulties were met in its treatment, which on investigation proved to be due to the presence of nickel. Mines were opened by the Canadian Copper Company, employing American capital, and also by the Vivians of Swansea, who, however, retired from the field a number of years ago. The Canadian Copper Company and the Mond Nickel Company—the latter an English concern—are the two chief producers, the works of the former being at Copper Cliff and the latter at Coniston.

A small proportion of nickel—say, $2\frac{1}{2}$ or 3 per cent.—when alloyed with steel imparts to the latter many advantages. It greatly adds to its strength and toughness, and, in addition, imparts a high degree of non-corrosibility. Early advantage was taken of this property of nickel by manufacturers of armor-plate for battleships. These, when cemented and face-hardened, presented a great resistance to the penetration of projectiles, and the impact of the latter failed to crack them. For heavy ordnance nickel steel is invaluable, and is also used in the manufacture of cartridges and other articles of military equipment. In fact, wherever strength combined with lightness is desired, nickel-steel is in demand. The new Québec bridge over the St. Lawrence River and the Manhattan Bridge over the East River at New York are made of nickel-steel. For coinage purposes, electro-plating of metallic objects, the manufacture of Britannia ware and for many other purposes nickel is also employed.

The development of the nickel-copper industry in the Sudbury district is going on rapidly, and the great demand for nickel owing to the present war is obliging the companies to push production to the limits of their capacity. In 1910 the quantity of nickel turned out was 18,636 tons and of copper 9,630 tons. The outbreak of the war last year disturbed conditions for a short time, but the mines were ere long again at work, and the production of 1914 amounted to 22,750 tons of nickel and 14,448 tons of copper. The production for 1915 was about 32,000 tons of nickel and 18,750 tons of copper. The united value of which at the prices of the refined metals would be not less than thirty millions of dollars. The ore after being raised to the surface is crushed to hand size and sorted, then roasted in huge heaps in the open air. The roasted ore is smelted to a low-grade matte, which is converted by the Bessemer process into a matte containing 75 or 80 per cent. of the metals combined. The Canadian Copper Company's matte carries, say, 50 per cent. of nickel and 25 per cent. of copper,

and the Mond Company's matte about 40 per cent. of each. The Bessemer matte is exported by the Canadian Copper Company to Constable Hook, N.J., and by the Mond Company to Clydach, Wales, for final separation of the metals. In addition to copper and nickel the mattes yield gold, silver, platinum and palladium. At the Mond Nickel Company's works the copper is recovered as copper sulphate, which is in demand in the vine-growing countries of Europe as an antidote to the phylloxera.

Early in the history of nickel mining the Government of Ontario offered to the Imperial authorities of the day a substantial—possibly a controlling—interest in the nickel deposits of the Province, asking the British Government in return to establish refining works and a plant for the manufacture of nickel steel. The proposition did not commend itself to the Home Government, which believed it could depend upon the ordinary channels of trade for the supply of its wants. There is a strong feeling in Canada that the refining of this important metal should not be committed to the care of a foreign country, and the Government of the Province has appointed a Commission to examine and report upon the whole nickel question.

DEVELOPING CHENEY PROPERTY AT THESSALON.

The Thessalon Advocate says: The most important event in the history of Thessalon for many years is the development of the Cheney Mine, recently purchased by the Timmins Bros. of Hollinger fame. This property which lies about 28 miles north-east of Thessalon, in Gould Township, and is accessible by good wagon and sleigh roads, has been opened up for some twenty years, having first been taken up by Mr. John McCreight, formerly of Thessalon, and sold to Mr. F. A. Cheney, of Elmira, N.Y. Mr. Cheney was making arrangements for developing the property on an extensive scale about sixteen years ago when he died suddenly and the plans for the development were not carried out. The property is now in charge of Mr. Pare, mining engineer, who is installing machinery and erecting buildings.

The Cheney is not, according to the Advocate, the only property of importance in this locality. Joining it on the east is the property owned by Mr. J. A. McEachern, on which ore carrying gold, copper and silver has been found. Mr. McEachern is taking out a few sample carloads with a view of obtaining smelter tests of the possibilities of this ore. To the south-west of these properties, on the bank of the Mississagi River, lies another vein called the War Eagle, a very wide vein carrying chalconite and some native copper.

DELORO PROPERTIES TO BE WORKED.

Mr. Clifford E. Smith of Toronto has taken a working option on the property of the Ankerite Gold Mining Company in Deloro Township, otherwise known as the Armstrong-McGibbon group, and will shortly begin operations. Considerable exploratory work was done on these claims previous to the disastrous fire of 1911. Promising results were obtained, but adverse financial conditions brought the work to an end. Since then no work has been done. Vigorous exploration will now be undertaken.

The adjoining claims, known as the Maidens McDonald, have been acquired under option by Mr. G. C. Bateman of Toronto, and development work has been started.

*From the Financial Times, London.

THE PROPOSED TAX ON PROFITS

In introducing his proposed tax on profits Hon. Sir Wm. Thomas White said:

"There are in time of war many businesses and industries, which for one reason or another are able to maintain profits above the average return to capital in time of peace. There are others whose profits arise directly from the manufacture of munitions or the furnishing of supplies in connection with the war itself and are in some instances of abnormal character. It has appeared to the Government that persons, firms, and corporations whose profits have been such might well be called upon to contribute a share to the carrying on of the war. Their position being advantageous as compared with less fortunate fellow-citizens, it is just that a portion of their advantage should be appropriated to the benefit of the state. In this connection we have prepared a measure which I propose to introduce to the House, providing for the taxation of profits in excess of a certain percentage upon capital engaged in all classes of business and industry, including railway, steamship, public utility, financial, commercial, milling, mining, and industrial enterprises.

"We have fixed upon a rate of profit in the case of corporations, individuals and firms which may be taken as a fair annual return in normal times. We propose to impose taxation to the extent of one-fourth of the amount of net profits upon the capital derived since the outbreak of the war in excess of this fixed rate. To particularize, our proposal is as follows:

"Upon all incorporated companies carrying on business in Canada, excepting life insurance companies, which are otherwise dealt with, and those engaged in agriculture, we propose to impose a tax of one-fourth of the net profits for every accumulating period ending since the outbreak of war in excess of seven per cent. upon paid-up capital. Provision is made for determining the profits and paid-up capital made and employed in Canada in the case of non-Canadian companies carrying on business in Canada and subject to the tax.

"From my statement it will be gathered that what we propose is a very comprehensive measure of taxation, not confined to those who have since the outbreak of war made more than their usual profits, but applying to all businesses, whether in existence before the war or established after its outbreak, whose profits exceed the percentages which I have mentioned.

"No doubt in the administration of this legislation some anomalies will arise, but these are inseparable from any comprehensive scheme of taxation upon a numerous class of the community. I am confident that those upon whom the burden will fall will gladly make the contribution which it calls for to the cause for which we are contending.

Extracts from the resolutions follow:

The accounting period shall be taken to be the period for which the accounts of the trade or business have been made up, but where the accounts of the trade or business have not been made up for any definite period or for the period for which they have been usually made up, or if a year or more has elapsed without the accounts being made up, the accounting period shall be taken to be such period and ending on such a date as the minister may determine.

The profits shall be taken to be the net profits arising in the accounting period.

(2.) The profits of a non-Canadian company shall be such proportion of the net profits as shall bear the same proportion to the total amount of its net profit as the capital of the company as defined herein bears to the total amount paid up upon its capital stock.

(3.) No deductions from gross profits for depreciation or for any expenditure of a capital nature for renewals, or for the development of a trade or business, or otherwise in respect of the trade or business, shall be allowed except such amount as appears to the minister to be reasonable and to be properly attributable to the accounting period.

The capital employed in the trade or business of an incorporated company having its head office or other principal place of business in Canada shall be the amount paid up on its capital stock.

The capital employed in the trade or business of a non-Canadian company shall be such portion of the amount paid up on its capital stock as shall bear the same proportion to the amount paid up on its entire capital stock as the value of its assets in Canada bears to the value of its assets outside Canada.

The minister may determine the amount of the capital of any incorporated company issuing stock after the fifteenth day of February, one thousand nine hundred and sixteen, and if, after the said fifteenth day of February, one thousand nine hundred and sixteen, the capital stock of any incorporated company is increased or additional stock is issued, or if the stock is in any way changed or reorganized in such a manner as to increase the amount of the capital, the minister may decide whether or not it is fair and proper to include such increase or any part thereof when determining the capital stock of such company, and the decision of the minister shall be final and conclusive.

The report of House of Commons Debates shows the following, under date of Feb. 18, 1916:

Mr. Graham: Might I ask the Minister of Finance if his new tax will apply to mining companies, whose profits, of course, are terminable, in the same way as it will apply to ordinary incorporated companies?

Sir Thomas White: It will apply to mining companies; but whether or not the details will be precisely the same as in respect to other companies, is a matter which I have under advisement.

JUPITER.

At the Jupiter mine a building 30 by 30 feet is now under construction for housing of the compressors and hoist. No efforts are being spared to get the plant installed as quickly as possible; meanwhile mining operations are being pushed vigorously. The two compressors, which are said to have a capacity of seven drills each, will be electrically driven and for this purpose two 125-horse-power motors are being installed. An entirely separate building to house these and the transformers is in course of erection.—Porcupine Herald.

KOWKASH.

Porcupine, Feb. 19.—Mr. Scobie is back from Kowkash, where he has been for the last three months. He informed the "Porcupine Herald" that the King Dodds property is going ahead and that heavier machinery is going in. Mr. King Dodds is back at the property, and it is said that the O'Brien interests are examining it. Some mining activity is reported at Redmond.

MANUFACTURE AND USES OF ALLOY STEELS.

"Manufacture and Uses of Alloy Steels," is the title of Bulletin 100, just issued by the United States Bureau of Mines. Henry D. Hibbard, the author, in the introduction to the bulletin, says: "The object of this report is to give briefly information of present value relating to the manufacture and uses of the various commercial alloy steels with the hope of stimulating the demand for such steels and extending their practical use. The report is issued by the Bureau of Mines as a contribution to the increase of efficiency in the preparation and utilization of mineral resources."

"Alloy steels are included in the so-called special steels, but as the latter term is often used in the mills to designate broadly any steels intended for purposes other than those served by the regular product, it has seemed best to use the more specific term of alloy steels in this report."

"Alloy steels are bringing about a series of revolutions in various industrial fields in which steel plays an important part. Most elements that could be procured in sufficient quantity have been alloyed with iron in various proportions, either alone or in combination with others, in the search for useful alloy steels. Those steels that have gained and maintained for themselves a place in current use are discussed in this report. Some of them have had an ephemeral life of usefulness which would no doubt have been prolonged had not some other more satisfactory steel been developed."

"Probably the first useful alloy steel was Mushet's self-hardening tungsten tool steel, patented in 1868. Fifteen years later Chromium steel, really containing chromium, was struggling for recognition for some purposes, the chief of which was for the manufacture of solid shot for piercing armor. In both of these steels the effect of the alloying element as used was in a way proportional to the amount contained. In 1882, Hadfield made his epoch-making discovery of manganese steel and demonstrated that in iron metallurgy it is not safe to take for granted anything as to the properties of an alloy of iron with other elements, basing one's opinion on past experience and knowledge, and that the effect of an alloying element may not be proportional to its content. The development of useful nickel steels followed in a few years and the field thus opened has since then been worked by many able and zealous men, with results of great importance and value."

The bulletin treats of simple tungsten steels, simple chromium steels, manganese steel, simple nickel steels, nickel-chromium steels, silicon steels, high speed tool steels, and chromium-vanadium steels.

In conclusion, the author says: "Further advance in the development of new alloy steels, as well as many new applications of those alloy steels already established, are to be expected. Trials are continually being made of new alloys of promise, some of which will doubtless win place in the list of useful alloy steels. Hadfield's iron alloy containing 5 per cent. manganese and 15 per cent. nickel, although not at present of use, may become so in the future, as its properties are rather remarkable."

"As some of the alloys in steel, as well as any heat treatment it may have received, affect the carbon contained so that its effect in the color determination is changed, the regular practice in some steel-works

laboratories is to make all carbon determinations gravimetrically by direct combustion of the whole sample with oxygen. This procedure avoids the uncertainties and errors of the color determination in analyzing heat-treated alloy steels."

A copy of this bulletin may be obtained by addressing the Director of the Bureau of Mines, Washington, D.C.

PROFIT-SHARING IN IDAHO.

The following announcement has been posted at Kellogg, Coeur d'Alene district, Idaho:

"To all employees of the Bunker Hill & Sullivan Mining and Concentrating Co., Caledonia Mining Co., Sierra Nevada Consolidated Mining Co., and Ontario Mining Co.: Hereafter, when lead is 5c. per lb., or higher, a profit-sharing bonus will be paid in addition to the regular or minimum scale of wages, as follows: 25c. per shift when lead is 5c. and under 5.5c. per lb.; 50c. per shift when lead is 5.5c. and under 6c. per lb.; 75c. per shift when lead is 6c. per lb. and over. The price of lead applying to be the average New York price for the preceding month. During January, 1916, the average New York price of lead was 5.84c per lb. and accordingly for February, 1916, a bonus of 50c. per shift will be paid all employees, and subsequent months in the same manner. When the average price of lead at New York is less than 5c. per lb. no bonus will be paid, and the regular scale applied."

DOMES EXTENSION.

Cobalt, Feb. 19.—Two drills are working on the 200-ft. level of the Dome Extension, drifting on a promising vein extension from the Dome property. About fourteen men are on the pay-roll. It is understood that the company is considering the letting of a contract for a considerable amount of diamond drilling in order to test a number of known veins at depth, in hopes of picking up extensions of the Dome vein systems.

CANADIAN MINING INSTITUTE

The annual meeting of the Canadian Mining Institute will be held in Ottawa this week, March 1st, 2nd and 3rd. Undoubtedly the most interesting subject of discussion will be the proposed tax on mining company profits. Action will probably be taken by the Institute. There should be a large attendance at the meeting.

COLEMAN COUNCIL ACTS.

Cobalt, Feb. 22.—At a special meeting of Coleman Township Council, held this afternoon, a resolution was passed to be forwarded to Ottawa asking that in the levying of the proposed war tax the profits of gold and silver mining companies be not on the same basis as industrial companies. The Cobalt Town Council, at its regular meeting last night, passed a similar resolution to be forwarded to Sir Thomas White.

CORDOVA MINES.

The gold mine at Cordova is to be reopened shortly by Mr. P. Kirkegaard. Additional machinery will be purchased.

PERSONAL AND GENERAL

Dr. W. G. Miller attended the annual meeting of the American Institute of Mining Engineers in New York. Mr. R. B. Watson is in New York.

Mr. John T. Stirling, chief inspector of mines of Alberta, is back at his office after undergoing an operation for appendicitis.

Dr. W. G. Miller, Provincial Geologist of Ontario, sailed from New York on the "Adriatic" on Feb. 17th for England. His address there will be: c/o Ontario Government Office, 163 Strand, London, W. C.

Mr. R. F. and W. E. Segsworth returned to Toronto from Cleveland last week and left for Ottawa.

Mr. A. J. Brant is at Porcupine making arrangements for development of the Korea property.

Dr. E. L. Bruce of the staff of the Geological Survey is at the University of Wisconsin.

Mr. W. E. Segsworth has returned to Toronto from Ottawa.

Mr. T. R. Finneane has returned to Cobalt.

Mr. P. Kirkegaard is reopening the gold mines at Cordova, Ont. Some new equipment will be purchased.

Messrs. E. M. Richardson and W. B. Albright of the R. A. P. Syndicate visited the property at Boston Creek last week.

Hon. Frank Cochrane, Minister of Railways and Canals, has been ordered by his doctor to take a complete rest.

Mr. Kirby Thomas and Mr. Morgan Cartwright visited the Adanac mine last month. Mr. Thomas is consulting engineer for the Adanac Company.

Mr. T. Walter Beam, of Denver, Colorado, who spent two seasons in Camp Hedley, Similkameen district, B.C., directing diamond-drilling operations on a group of mineral claims near Hedley that the New York Syndicate No. 2 was exploring under an option of purchase, has gone to Sutter Creek, Amador County, California, as manager of the old Eureka mine.

Mr. Maurice W. Bacon, of Spokane, Washington, who several months ago retired from the management of the mining operations of the Stewart Mining Co. in the Coeur d'Alene district, Idaho, was lately in Victoria, B.C., seeking Government assistance to make more accessible the copper-mining property in Quatsino division, Vancouver Island, he and his associates have been developing during parts of the last two years.

Mr. Ed. Dedolph, of Kaslo, B.C., for some time engaged by the Mines Branch of the Canada Department of Mines in research work in connection with electric smelting of zinc-lead ores at McGill University and afterward at Nelson, B.C., was in Spokane, Washington, last month.

Mr. W. E. Henry, representative at Spokane, Washington, of the Empire Zinc Co., of St. Louis, Mo.; Mr. G. S. Brooks, for some time with the Mineral Point Zinc Co., Perdue, Ill., and Mr. C. C. Mitchie, also of the Empire Zinc Co.'s staff, last month visited the Consolidated Mining and Smelting Co.'s reduction works at Trail, B.C.

Mr. Harold Lakes, formerly superintendent at the Silver Hoard mine, in Ainsworth Camp, B.C., has been appointed superintendent at the Lucky Jim zinc mine, situated on the mountain divide near the eastern boundary of Sloean mining division, also in British Columbia.

Mr. W. B. Timm has lately been investigating for the Dominion Government the deposit of molybdenite

on Lost Creek, in the southern part of Nelson Mining division, British Columbia.

Mr. W. Yolen Williams, of Spokane, Washington, who during the earlier years of the Granby Consolidated Co.'s important mining development work was the company's mine superintendent, was examining mining properties in Ainsworth mining division last month.

Mr. D. C. Stephens, superintendent of the Tacoma Steel Co.'s Marble Bay gold-copper mine at Vananda, Texada Island, B.C., has been on a visit to Tacoma and Seattle, Puget Sound, Washington.

Mr. J. R. Lockard, manager for the Canadian Collieries (Dunsmuir) Limited, has returned to Vancouver Island, B.C., from a business trip to the East.

Obituary Note.

On Sunday, February 13, the death occurred at Victoria, B.C., of Mr. George Sheldon Williams, manager and editor of the British Columbia Mining and Engineering Exchange, published in Vancouver, B.C., for the last fifteen or sixteen years. Besides his active connection with the mining publication mentioned, the late Mr. Williams was a frequent contributor to the newspaper press. He was a man of athletic habits and seemingly in vigorous health until he had a paralytic stroke several months ago. For a while he appeared to be recovering his wonted health and strength and was able to get out and about, but a relapse occurred and he rapidly failed until his death at the comparatively early age of 49 years. Interment of his body took place at Victoria under Masonic auspices on February 16.

CONSOLIDATED M. & S. CO.

The purchase of the common stock of the West Kootenay Power and Light Co. was ratified by the shareholders of the Consolidated Mining and Smelting Co. of Canada, at their meeting held in Toronto on Feb. 7. The basis of the deal is an exchange of \$75 par value of Consolidated Co.'s stock for \$100 par value of West Kootenay. This arrangement will give the Consolidated company the whole of the common stock issue of West Kootenay, amounting to \$2,000,000, and therefore control of the power company. The ratification of the deal was almost unanimous as the directors held 75 per cent. of the Consolidated Co.'s stock by proxy. The deal was favorably received. Earnings of the West Kootenay Company, after providing for preferred dividends and bond interest, have yielded quite ten per cent. on the common. Now that the Consolidated Co. has control its power supply will be cheaper. Formerly it bought power from the West Kootenay Co. No new authorization for capital will be necessary.

The purchase of the West Kootenay Company's property has an important bearing on the future of the whole smelting company's enterprise. Even after the contract with the Canadian Government for supply of zinc shall end, the cheaper power now available, it was stated by officials at the meeting, will permit of the manufacture of zinc at a profit to the company.

Another matter ratified by the shareholders was the proposal to split the Consolidated Co.'s shares into four, each new share to have par value of \$25.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

West Kootenay.

Coast District.—The following information relative to mining on Princess Royal Island is of more than ordinary interest, since it indicates the entry into mining operations in this district of another experienced mining company from the United States. The excerpt has been taken from a recent publication of the British Columbia Department of Mines:

"**The D. L. S. Group at Surf Inlet**, Princess Royal Island, which has been under bond for the past two years to the Tonopah-Belmont Development Co. of Tonopah, Nevada, was purchased by that company at the end of 1915. The price paid was \$150,000 for an 80 per cent. interest, the original company, the Surf Inlet Gold Mines, Limited, retaining one-fifth of the stock. In addition to this, the Tonopah Company agreed to put up a 250-ton mill, the construction of which will be started immediately. This will mean that a new gold-producing mine, in a hitherto unproductive region, will soon be added to the shipping mines of the province.

"The Tonopah Company will have spent, by the time the mill is completed and with development and purchase moneys, close to \$1,000,000, and it is therefore to be presumed that they have, in the development work, proved up a considerable tonnage of ore.

"The orebodies consist of veins and masses of quartz containing pyrite, in sheared fissure zones in granite, and are sometimes of considerable size. The value is in gold and possibly a very little silver, occurring partly in the pyrite and partly free. It is not known what type of mill is to be erected, but it should be a comparatively easy ore to treat."

East Kootenay.

Sullivan Mine Shipments.—So far as known, the Sullivan mine made a record of ore shipments to Trail during three recent weeks. Trail smelter figures show that during the week ended January 27 there was received 1,324 tons of Sullivan ore, 1,321 tons during the week ended February 3, and 1,550 tons during the week ended February 10; total for the three weeks, 4,195 tons, which is nearly 1,400 tons a week for three successive weeks. There have been times at which more than 1,000 tons was received in each of two successive weeks, but not during a longer period. The weekly average for the calendar year 1915 was 856 tons of lead ore received at Trail; that for the six expired weeks of 1916, to February 10, inclusive, was 1,001 tons. It is expected that when the Consolidated Mining and Smelting Company of Canada's electrolytic zinc refining plant shall be in operation the average weekly output of the Sullivan mine, of lead and zinc ore, will show a substantial further increase. In his report for the Consolidated Company's last fiscal year, presented to the shareholders on December 28, 1915, the general manager, after making brief reference to the electrolytic zinc plant then being put in at the company's works near Trail, B.C., said: "It is hoped that this plant will be in operation early in the year. Its operation should make available a very large amount of complex ore at the Sullivan mine, and the extraction of that ore will probably lead to the development of further bodies of lead ore in the same mine."

Ainsworth.—In comparison with the corresponding period of 1915, there is in 1916 a very marked improvement in mining conditions in Ainsworth division. Ore shipments totalling 1,784 tons have been made from seven mines during six weeks ended February 10 of this year against only 101 tons from four mines during the first six weeks of 1915. A further considerable increase in output may be expected in the spring, as soon as sufficient water shall be available for the operation of two or three concentrating plants now idle owing to there not being enough water to meet the power requirements of their respective mills.

Slocan.—Eleven mines in Slocan division and three in Slocan City are on this year's ore-shipping list. Those in the first-mentioned division are the Apex, Comstock, Galena Farm, Hewitt-Lorna Doone, Noonday, Rambler-Cariboo, Reco, Ruth, Socan Star, Standard, and Yakima; in Slocan City division there are the Black Prince, Enterprise, and Meteor. These mines have shipped ore to Trail. It is probable there are one or two others that last year shipped to United States reduction works and are continuing to do so this year, but of these there is not a similar record as in the case of those that send their ore and concentrates to a district smelter.

Nelson.—The Provincial Mineralogist, in his Preliminary Review of Mining in the Province in 1915, states that there was a heavy decline in the lode-gold output of Nelson division in 1915. He makes brief comment on the gold mines, as follows: "A reduction of about 7,000 oz. of gold is estimated for the Nelson district, or nearly 46 per cent. This decrease is mainly due to a falling off in the production of the Motherlode mine on Sheep Creek, where the cyanide mill was operated only a short time owing to the exhaustion of the developed ore reserves at the mine. The mine is at present closed and the future plans of the company are not known. The Queen mine, on Sheep Creek, made about the same product as the previous year, and it is said that development work on the lower levels is proving satisfactory in showing the continuation of the ore shoots. The Second Relief, near Erie, milled more ore than in 1914, and the Granite-Poorman, near Nelson, again entered the list of producers. The Yankee Girl mine, at Ymir, did not ship any ore, but a low-level tunnel was driven into the vein and drifting was commenced on it. This work is now progressing and good ore is being found. It is probable a mill will be erected on the property in the near future."

Rossland.—Ore shipments to Trail during the first half of February were about 500 tons a week less than during January, doubtless attributable to the heavy snowfall, which somewhat hindered operations above ground. The output for two weeks was as follows: From Centre Star group 5,671 tons; Le Roi, 4,424 tons; Josie (Le Roi No. 2, Ltd.), 730 tons; Velvet, 33 tons; total, 10,858 tons, an average of 5,429 tons a week, which compares with 5,945 tons a week for four weeks ended January 27. The shipment from the Velvet was the first made from that mine for several years, the property having been unworked for some time.

The report of the Josie mine for December, made by the Le Roi No. 2 Company's managers at Rossland to its London office, was made public in British Columbia about the middle of February. It shows total receipts

in the month reported on to have been \$11,098 and expenditures, \$18,729. An office note states that "Payments for 817 tons only were received during the month, although 1,317 tons of first-class ore was hoisted, of which 1,120 tons was shipped. Receipts and estimated working costs, etc., for the last three months of 1915 were as under:

	Receipts.	Expenditures.
October	\$14,922	\$15,647
November	34,700	18,700
December	11,098	18,729
Totals	\$60,720	\$53,076

Expenditures were as follows: For ore production, \$23,700; milling, \$1,700; development (including diamond-drilling), \$24,970; stores purchased but unused, \$1,747; on capital account, \$959.

Trail.—Ore receipts during the week ended February 3 totalled 8,374 tons, and for that ended February 10, 8,039 tons. These totals compare with a weekly average of 8,019 tons for four weeks ended January 27. No ore was received during the week ended February 10 from Republic mines, in the State of Washington, probably due to railway transportation difficulties caused by much more snow having fallen in the district than in ordinary winters, for in no other week since the shipment of ore from Republic mines to Trail was resumed in the summer of 1914 was there a similar experience.

INTERNATIONAL NICKEL.

In the House of Commons on Tuesday, Feb. 22, Col. John Currie, member for North Simcoe, according to a "Toronto World" reporter stated that some of our great copper deposits are controlled by German syndicates and a great part of the nickel deposits of the Sudbury district were controlled by Krupp, the German gunmaker, through trustees residing in the United States. Canada, he said, should follow the example of Australia which had terminated German ownership of zinc concentrates and copper.

"Our Government should at once investigate the International Nickel Co. and ascertain if the statements made about that corporation on the floor of the British House of Commons were justified by the facts. We had practically a monopoly of nickel, and we had the advantage of all the world in manufacturing electric steel. The Government should be able to get enough out of our nickel deposits to carry the burden of the war debt. We could make chrome steel, and, indeed, could monopolize the manufacture of cannon. No nation was so well suited for the manufacture of rifles, guns and armaments of every kind."

E. W. Nesbitt (N. Oxford) informed the House that no Germans had stock in the International Nickel Co.

Mr. Nesbitt said: "There was one point raised by the hon. member for North Simcoe (Mr. Currie) regarding which I would like to say one word. He said that the nickel industry in Canada was controlled by Germany. I know some officers of the nickel corporation, and I know that there is not a human being in Germany who has any control, or who has anything to do with the Canadian nickel interests. I think the ministers know that as well as I do. I have been told by officers of the nickel company that they would be perfectly willing to have any investigation that might be thought desirable to clear away any doubts as to German control."

COBALT SHIPMENTS.

Cobalt, Feb. 19.—The ore shipments this week are considerably lower than last. The total number of pounds shipped for the week ending last night was 491,970 pounds compared with 687,924 pounds a week ago. Six cars were dispatched from as many companies. The heaviest car came from Dominion Reduction and contained 88,000 pounds. La Rose was next with 87,140 pounds. Ore shipments for the week were:

Company.	Pounds.
McKinley-Darragh	84,924
Dominion Reduction	88,000
Mining Corporation	84,525
La Rose	87,140
Buffalo	75,385
Penn Canadian	71,996

Total 491,970

Bullion shipments for the year to date are as follows:

	Ounces.	Value.
Nipissing	409,282.56	\$233,680.01
Mining Corporation	53,774.62	30,798.77
Crown Reserve	47,000.00	28,300.00
Dominion Reduction	65,000.00	37,050.00
O'Brien Mine	36,987.00	21,542.46

Total 612,044.18 \$351,371.24

The Manitoba Government is said to have purchased in England a gas-producer plant for the purpose of testing the possibilities of Manitoba and Saskatchewan lignite coal. It should arrive about the end of the month and will be installed at the town of Souris. It is claimed that gas can be produced at a cheap rate and piped in large quantities to urban centres.

The oldest daily newspaper in Vancouver, B.C., the "News-Advertiser," says: "The time has come for a new departure in the mining industry of British Columbia. If we understand the attitude of the new Minister of Mines he will never be content with the production of metals for export in their crudest form. The smelting and refining industries are of more importance in the development of the province than the production of the ore. Primary and secondary metal industries should go together. We have not only the raw material, but the fuel and the natural water powers to produce electricity. We have the same markets for refined metals and for brass as have the people to whom we have been selling ore. We have or can have the same labor. Every metal industry creates its market for skilled and unskilled labor, for farm, for forest and fishery products, and for manufactures. This is one of the roads to a well organized population with balanced and adjusted interests and industries."

BOSTON CREEK.

The new plant at the Richardson, Albright and Passimakes' property at Boston Creek is now installed and in operation, says The Cobalt Nugget. The No. 2 shaft is down to a depth of 105 ft. and some ore is being recovered. The plant was in operation last week for the first time. The compressor is a Rand, three-drill, steam-driven, and the hoist is adequate to work to a depth of four hundred ft.

TRETHEWEY.

The annual meeting of Trethewey Mines, Limited, was held in Toronto Feb. 23. All the old directors and officers were re-elected.

MARKETS

NEW YORK MARKETS.

Feb. 21, 1916—Connellsville coke (f.o.b. ovens)—

Furnace, spot, \$3.25 to \$3.50.

1st half \$2.35 to \$2.50; Year 1916, \$2.25 to \$2.35.

Foundry, prompt, \$3.75 to \$4.00.

Foundry, contract, \$3.25 to \$3.75.

Straits, tin, f.o.b., 42.25 cents.

Copper—

Prime Lake, nominal, 28.00 to 28.50 cents.

Electrolytic, nominal, 28.00 to 28.50 cents.

Casting, nominal, 26.75 to 27.00 cents.

Lead, Trust price, 6.30 cents.

Lead, outside, 6.30 cents.

Spelter, prompt western shipment, nominal, 20.92½ to 21.17½ cents.

Antimony—

English brands, nominal.

Chinese and Jap, 43.50 to 44.50 cents.

American, 43.50 to 44.50 cents.

Aluminum—

No. 1 virgin, 98-99 per cent., 58.00 to 60.00 cents.

Pure, 98-99 per cent. remelt, 56.00 to 58.00 cents.

No. 12 alloy remelt, 47.00 to 49.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$275 to \$290.

Platinum, nominal, \$88.00 to \$100.00.

Cobalt (metallic), \$1.25.

Silver (official), 56¾ cents.

Metal Products.—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 35.00 cents.

Copper wire, base, 29.25 to 29.75 cents.

High sheet brass, base, 38.00 to 40.00 cents.

Seamless brass tubing, 41.00 to 43.00 cents.

Seamless copper tubing, 42.00 to 44.00 cents.

Brazed tubing, 45.50 to 47.50.

Brass wire, 38.00 to 40.00 cents.

Brass rods, 38.00 to 40.00 cents.

Sheet zinc, f.o.b. smelter, 25.00 cents.

TORONTO MARKETS.

Feb. 23—(Quotations from Canada Metal Co., Toronto)—

Spelter, 25 cents per lb.

Lead, 8 cents per lb.

Tin, 47 cents per lb.

Antimony, 48 cents per lb.

Copper casting, 31 cents per lb.

Electrolytic, 31 cents per lb.

Ingot brass, yellow, 13c.; red, 15 cents per lb.

Feb. 23.—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8.00 per ton.

Coal, bituminous, \$5.75 per ton.

SILVER PRICES.

		New York,	London,
		cents.	pence.
Feb. 9	.....	56¾	27
" 10	.....	56¾	27
" 11	.....	56¾	27
" 12	.....	Holiday	26½
" 14	.....	56¾	26¾
" 15	.....	56½	26½
" 16	.....	56¾	26½
" 17	.....	56¾	26¾

" 18	.....	56¾	....
" 19	.....	56¾	26¾
" 21	.....	56¾	26½

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto.)

New York Curb.

	Bid.	Asked.
Butte	7¾	7¾
Curtiss Aeroplane	45	50
Canada Copper	1¾	1¾
Canada Cement	1½	1½
Emma Copper	60	64
Howe Sound	5½	5½
International Petroleum	12½	12¾
International Nickel (new)	48	47
Kennecott Copper	55¾	55¾
Maxim Munitions	5	6
Midvale Steel	7¾	8
Marconi	3½	3¾
Mother Lode	21½	22
Steel of Canada	39¾	40¼
Submarine Boat	36	37
Tonopah Extension	4¾	4¾
U. S. Light (preferred)	5½	5¾
White Motors	50	51

Porcupine Stocks.

	Bid.	Asked.
Apex	.06¼	.06¾
Dome Extension	.28¼	.28½
Dome Lake	.25¼	.27½
Dome Mines	24.00	24.75
Hollinger	26.00	26.50
Jupiter	.21½	.22
McIntyre	.93	.95
McIntyre Extension	.25	.30
Porcupine Crown	...	.80
Porcupine Imperial	.03½	.04
Porcupine Vipond	.65	.67
Preston East Dome	.04¼	.04½
West Dome	.14¾	.15

Cobalt Stocks.

	Bid.	Asked.
Adanac	.60	...
Bailey	.05¾	.06
Beaver	.37½	.38
Buffalo	...	.90
Chambers Ferland	.23	.25
Coniagas	4.25	4.30
Crown Reserve	.42	.45
Foster	.09	.09¼
Gifford	.05¾	.06
Gould	.00½	.01
Great Northern	.42	.46
Hargraves	.04	.04½
Hudson Bay	26.00	...
Kerr Lake	3.90	4.00
La Rose	.60	.65
McKinley	.45	.47
Nipissing	6.25	6.50
Peterson Lake	.25	.25½
Right of Way	.04½	.05½
Seneca Superior	.47	.50
Silver Leaf	.02	.02¾
Temiskaming	.55	.56½
Trethewey	.14	.17
Wettlaufer	.07	.10

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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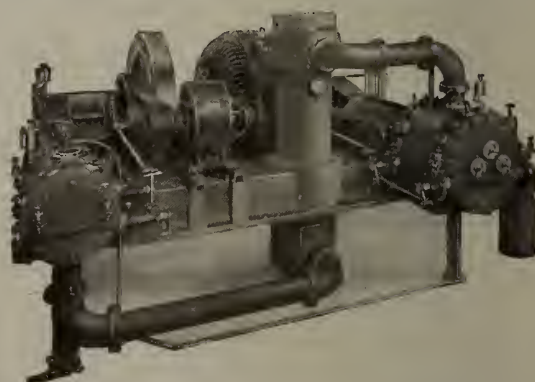
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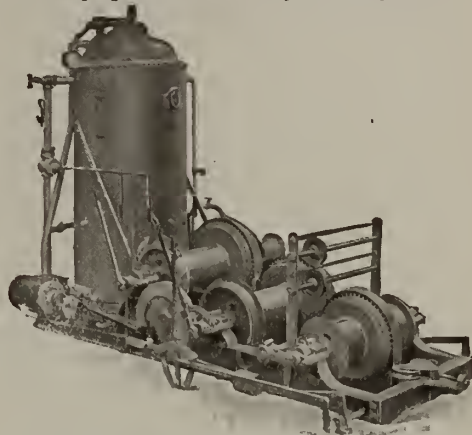
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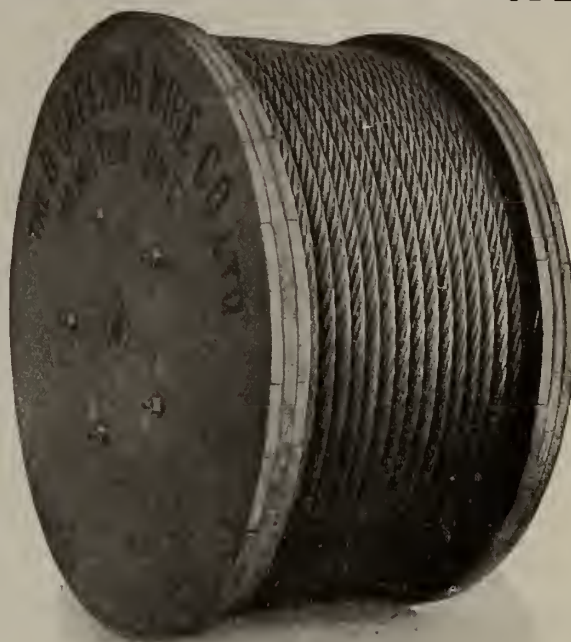
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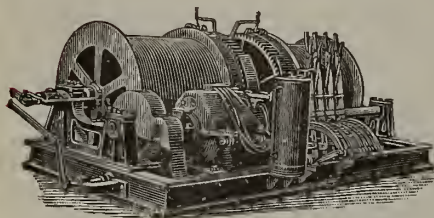
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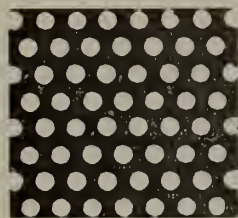
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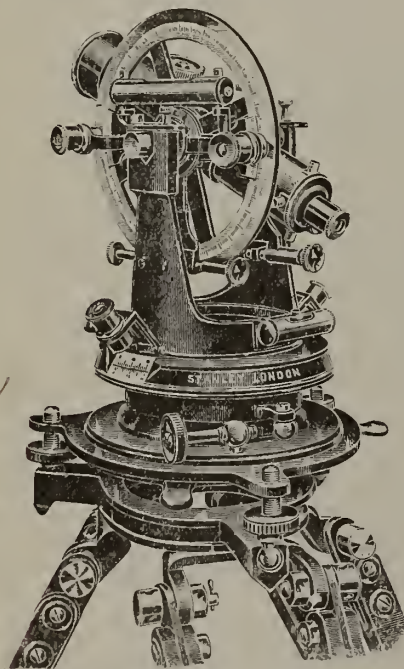
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Member American Institute of Mining Engineers.

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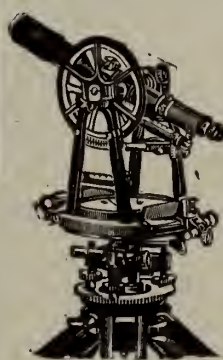
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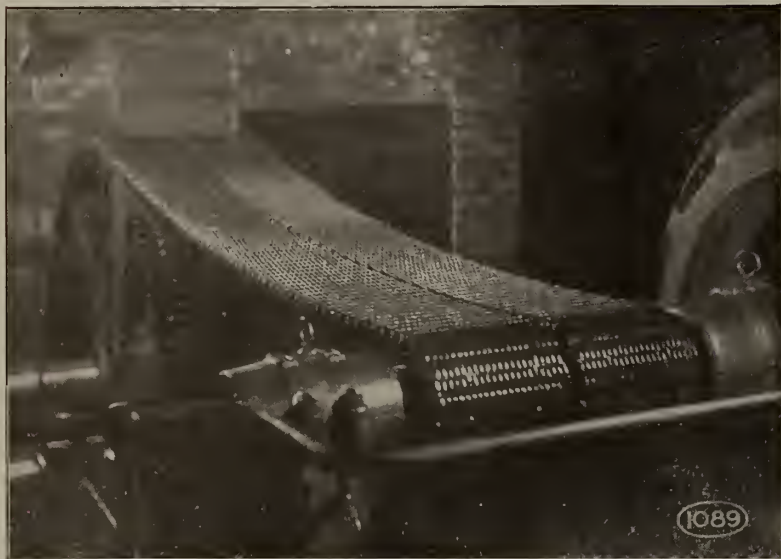
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Cobalt, Ont., May 18, 1914.
Messrs. Jones & Glassco,
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Replying to your favor of the 6th re your Renold Silent Chain, we have found this Chain Drive to be eminently satisfactory in every respect.

We have a 12-inch rubber belt on a 50 H.P. motor running beside a 60 H.P. motor driving Stamp Batteries with your Chain Drive.

A comparison of these two drives shows a saving of approximately \$20.00 since September, 1911, in repair parts, while the time spent on the Chain Drive has been less than on the belt.

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Yours truly,

The above comes from a prominent Cobalt Mining Co (name on application) and is signed by the Manager.

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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, March 15, 1916.

No. 6

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

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Head Office 263-5 Adelaide Street, West, Toronto

Branch Office 600 Read Bldg., Montreal

Editor

REGINALD E. HORE

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CIRCULATION

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A LIMIT SHOULD BE FIXED AND ANNOUNCED

Since the publication of our last issue we have received assurance that the mining industry will not be taxed so severely as indicated in the Budget speech of Sir Wm. Thomas White. An endeavor will be made to take into consideration factors peculiar to the mining industry and to each mining company. The amount to be collected from the companies is much less than the Budget speech indicated. We have been assured that great care will be taken to avoid crippling the companies and that short-lived mines will receive special consideration.

Sir Thomas proposes to administer the Act through the Finance Department. He has reserved great powers in connection with the administration and hopes to take into consideration the affairs of each company or group of companies and to arrive at an assessment that will be just for all. A less capable man than Sir Thomas would scarcely have undertaken such a task and we would have little confidence in almost anyone who attempted it. The Minister of Finance, however, has been so successful in carrying out things that he undertakes, that we have reason to confidently expect he will succeed in doing what he proposes.

We cannot, however, get over the impression that Sir Thomas is making a lot of unnecessary work for himself and his department. To arrive at the actual value of a mine at any time during its life is a difficult matter, difficult for those most familiar with the industry and doubly difficult for those whose experience in assessment work does not include experience in mine valuation. The determination of the value of a mine for taxation purposes is not a matter that should be undertaken with the idea that it can be accomplished without much thought and labor.

Many of the difficulties will be lessened by the fact that the companies are not endeavoring to escape taxation. They can be counted upon to co-operate with the Finance Department when official assurance is given that they will not be taxed unreasonably. Unfortunately the Finance Department takes the position that it must consider each case on its merits before the companies will know, even approximately, what they may be called upon to pay.

We do not expect that any mining company will be called upon to pay in war taxes more than ten per cent. of its profits as ordinarily calculated. An announcement to this effect could be made by the Government without interfering with the general plan proposed. It would fix a reasonable maximum which the companies could work on until they find out what Sir Thomas means by "capital" and "value of the assets."

The thanks of Canadian mining men are due to Mr. T. A. Rickard, editor of Mining and Scientific Press, for an admirable paper on Flotation Processes.

There is an excellent demand for magnesite for furnace linings. In Quebec several properties are being operated, and it is to be hoped that the industry will become well established while the demand is so good.

At the Canadian Mining Institute annual meeting, Professor Adam Shortt gave a very interesting address on "Gold and War Finance." His arguments were good, and he defended them well; but his deductions did not meet with general approval. One of his deductions was that the appreciation of the American dollar on the New York Exchange was a sign of financial weakness in the United States. Another deduction was that at present it is not important for Canada to increase production of gold.

The story of the discovery of phosphate of lime at Banff by Dr. Frank D. Adams and Mr. W. J. Dick was told at the Mining Institute meeting by Dr. Adams. It is a very interesting story and clearly illustrates the application of structural geology in the search for mineral deposits. Equally interesting was the story of Mr. W. F. Ferrier, who has been quietly prospecting for phosphate deposits in the Rocky Mountains during the past few years. Mr. Ferrier, until the meeting, had not obtained permission to make his work public. After Dr. Adams had told of the work done and prophesied that phosphate beds would be found in the vicinity of Banff, Mr. Ferrier rose and told how he had already prospected the district and found such beds; but had until then been unable to say anything about it. The two stories created a dramatic situation which appealed greatly to the meeting.

During 1915 there were, according to Mr. T. F. Sutherland, Chief Inspector of Mines, 22 fatal accidents at the mines, metallurgical works, quarries, clay and gravel pits regulated by the Mining Act of Ontario. Four farmers were killed by falls of sand and gravel in small pits over which the Department has no jurisdiction. There were none in the pits governed by the Act.

In addition to statistics and discussion of mining accidents Mr. Sutherland gives a description of new safety methods or equipment which the inspectors have noticed throughout the year; the water stopper and safety crosshead at the Hollinger mine; the Stokes stretcher, the electric return bell signal system, and the regulations and requirements regarding rope and hoist inspection of the Canadian Copper Company, a description of which was furnished by Mr. J. C. Nicholls, the company's superintendent of mines. Considerable information is also furnished regarding the regulations for hoisting operations in the pro-

posed Rules and Regulations for Metal Mines in the United States, published in Bulletin 75, of the U. S. Bureau of Mines.

Ontario now has several large shafts handling big tonnages. The Dome and Hollinger have each a six-compartment shaft; the Beaver has one shaft about 1,300 feet deep; Creighton has two shafts, one with four, and the other with five compartments, both over 1,000 feet deep. The Frood Extension shaft is 1,000 feet and the Victoria No. 1 shaft 2,300 feet deep.

It is difficult for the public to understand why mining men protest so strongly against the proposed taxes. In his presidential address, Mr. A. A. Cole made some pertinent remarks in this connection, to which we subscribe. Mr. Cole said: "The war has shown us the woeful lack of co-operation between many of our industries, in other words, the lack of application of scientific methods to our national activities. Germany's successes, both industrial and military, have been due to the fact that she has recognized the value of science and of engineering and has freely utilized these aids in the promotion of her objects. The Canadian Mining Institute is composed for the most part of scientifically trained men holding positions of various importance in the mining industry. The influence of these men on the country at large should be such that the general principles on which the industry is carried on should be fairly generally understood.

"But what are the facts of the case? Talk to the man on the street and you will be amazed in nine cases out of ten to find that he does not realize the basic difference between a mining and an industrial enterprise. He will tell you that the reason that a mining proposition should return twice the income of an industrial concern is because it is more risky whereas the mine may have all its capitalization blocked out ahead and be as safe as the Bank of England; and his own industrial concern may be in a most precarious condition. He has, in fact, never thought of that extra profit as a sinking fund or return of capital. Let us look to ourselves for much of the explanation of this general ignorance regarding the mining industry on the part of the man on the street."

There are many strange statements made in the House of Commons. We have heard few more misleading than W. F. Maclean's remarks concerning a new process for refining nickel. He says: "I believe that it is a fact that out of 100 pounds of our nickel ore we shall get 50 pounds of nickel, which is equivalent pound for pound of the nickel that is used in making nickel steel." Mr. Maclean deserves credit for his apparently sincere endeavor to have nickel refining done in Canada. We are, however, naturally surprised at some of his statements. They are amusing to most of us, but they are likely to do harm. Some of the members of the House may believe that he is serious, and that he is quoting facts.

ANNUAL MEETING CANADIAN MINING INSTITUTE

The annual meeting of the Canadian Mining Institute held at the Chateau Laurier, Ottawa, March 1st, 2nd and 3rd, was a distinct success. The chief topic of discussion was naturally the proposed tax on mining companies. As the membership includes many of the directors of Cobalt and Porcupine mining companies, the effect that the proposed legislation would have on the gold and silver mining industry received special attention.

Mr. Arthur A. Cole, Cobalt, was elected president for the coming year, in succession to Mr. G. G. S. Lindsey, who is now in China.

The other new officers elected were: Vice-President, Charles Fergie, Montreal; T. W. Gibson, Toronto, D. B. Dowling, Ottawa, and Thomas Cantley, New Glasgow; Councillors, J. A. Dresser, Montreal; Norman R. Fisher, Haileybury; Thos. Graham, Victoria; Gomer P. Jones, Hedley, B.C.; A. D. Miles, Copper Cliff; R. H. Morris, Pochontas, Alta.; M. E. Purcell, Rossland; W. E. Segsworth, Toronto; Clifford Smith, Toronto, and Lewis Stockett, Calgary.

An amendment to the by-laws providing for voting by letter ballot in future amendments to by-laws was carried. A proposal to make application for a Royal Charter was defeated.

In the discussion of Sir Thomas White's proposed tax it was shown clearly that the mining industry would have to pay much more than its proper share. In one case the tax would, on account of the retroactive clause, be so severe that it would take more ore than now remains in the mine to pay the three years' taxes. One mining company would have to pay about \$1,250,000 or one-sixteenth of the total amount required. Similar absurdities which the proposal would effect in other cases were pointed out. It was decided that an attempt should be made to point out to the Minister the unfairness of his proposals and the harmful effects which the carrying out of them would have. President-elect A. A. Cole was asked to name a committee to interview Sir Thomas. The committee chosen by Mr. Cole interviewed the Minister and were given assurance that the tax would not be as severe as indicated in the budget speech, as he intended to take into consideration factors peculiar to the mining industry.

Several very interesting papers were presented during the sessions. The program included the following:

"The Coal Situation in Canada," by W. J. Dick, Ottawa.

"The Carbonization and Briquetting of Saskatchewan Lignites," by S. M. Darling, Estevan, Sask.

"The Coal Resources of Canada, with Special Reference to the Metallurgical Industries," by Dr. J. Bon-sall Porter, Montreal.

"The Discovery of Phosphate of Lime in the Rocky Mountains," by Dr. F. D. Adams, Montreal, and W. J. Dick, Ottawa.

"Some Effects of the War on Canadian Mining and Metallurgical Industries," by Dr. Alfred Stansfield, Montreal.

"Zinc Occurrences at Notre Dame des Anges," by Dr. J. Austen Bancroft, Montreal.

"The Magnesite Industry in Canada," by Howells Frechette, Ottawa.

"The Concentration of an Ontario Magnetite and the Sintering Thereof for the Manufacture of Charcoal Pig Iron," by G. C. MacKenzie, Ottawa.

"Canadian Supplies of Iron and Steel in Relation to Munitions of War," by Thos. Cantley, New Glasgow, N.S.

"Copper Mining in Alaska," illustrated by colored lantern slides, by H. W. DuBois, Philadelphia, Pa.

"Canadian Gold and War Finance," by Dr. Adam Shortt, Ottawa.

"Gold Production and the War," by J. Murray Clark, Toronto.

"The Flotation Process," by T. A. Rickard.

"Recent Improvements in Concentration at the Washoe Reduction Works, Anaconda, Montana," by E. P. Mathewson, Anaconda, Mont.

"The Flotation of Bornite," by H. W. Dubois, Philadelphia, Pa.

"The Concentration of Canadian Molybdenite," by Henry E. Wood, Denver, Col.

"Some Conditions Affecting Education in Mining and Metallurgy," by Prof. J. C. Gwillim, Kingston.

"Mining Education," by L. D. Burling, Ottawa.

"Methods of Construction of Deep Mine Shafts in Water Bearing Material," by John W. Doty, New York.

"Rock Crushing Tests at McGill University," by Prof. J. W. Bell, Montreal.

"Mineral Deposits of the Buckingham District," by Morley E. Wilson, Ottawa.

"Petrolia, Past and Present," by John Stansfield, Montreal.

By the courtesy of Dr. J. Bonar, Deputy Master, members and others attending the meeting were enabled to visit the Royal Mint. Permission was also granted by Dr. Eugene Haanel, Director of the Mines Branch of the Department of Mines, for members to inspect the ore dressing and other laboratories of the Mines Department. Many members visited these institutions, as well as the Museum of the Geological Survey and the National Gallery under the guidance of members of the local committee.

The dinner, always one of the best features of the Institute's meetings, was held on Thursday evening. On Wednesday evening Mr. DuBois showed a splendid series of colored views illustrating the conditions under which mining is carried on in Alaska. Prof. Shortt followed with a dissertation on gold mining and war finance which aroused a lively discussion that lasted until midnight.

IN DELORO.

South Porcupine, March 5.—The Dominion Rand Mines Limited have been granted a charter and will take over and develop the Rand Syndicate properties in Deloro Township, about four miles south of Porcupine, in a week or so, as soon as the affairs of the syndicate and preliminary details are formally gone through with. Heavy machinery will be taken in on the snow before the break-up. A handful of men have been sinking on this property all winter and have encountered some splendid milling ore of good values. It is the intention of the company to push underground work ahead and get enough ore blocked out to ascertain the size and class of mill that will be necessary to treat the ore. We will have some further information about this property in a few days.—Porcupine Herald.

HEDLEY GOLD.

A quarterly dividend of 3 per cent. and an additional dividend of 2 per cent. payable March 31, 1916, has been declared by the Hedley Gold Mining Co.

THE METALLURGY OF COBALT SILVER ORES

III. LEACHING OF CHLORIDIZED SPEISS WITH CYANIDE

By Ralph W. Bridges

When the preliminary chloridizing roasting experiments, covered in Article II, Tables 1 and 2 (see Feb. 1 issue of Canadian Mining Journal) were completed and the loss of silver was seen to be quite low, the chloridized speiss resulting from this series of roasting experiments was used in making leaching tests with cyanide and hypo solutions to determine how much of the silver was in a soluble form and what per cent. could be recovered as bullion. This treatise deals only with the cyanide leaching.

In these experiments an Abbe mill was used. In it was placed a charge of 2,000 grams of chloridized speiss and 20 litres of cyanide solution. A ratio of 10 parts of cyanide solution to 1 part of chloridized speiss was maintained throughout the experiments.

The Abbe mill was rotated for a period of 10 hours. The solution was decanted and the tailings discharged onto a filter, washed, dried and weighed. The results of two sets of leaching tests are shown in Table No. 1.

The silver cyanide solution resulting from the leaching was used for a number of precipitation tests. Zinc dust and shavings and aluminum dust and shavings were used with satisfactory results. However, as the company had a large amount of surplus electrical power, it was decided to use the electrical current for precipitating the silver, should the cyanide process be adopted.

A number of tests were made in the laboratory to determine if all the silver could be precipitated, and the time and current required. Examples of these tests are as follows:—

(1) Took one assay ton of solution, silver content .06764 gr., diluted to 200 c.c. and electroplated with laboratory apparatus; Platinum anode, silver cathode; amperes 1, volts 14; time 4 hours.

Silver precipitated: .06748 gr. Left in solution: .00016 gr. Precipitation of silver: 99.76 per cent.

(2) Test of rapid precipitation by use of solenoid. Took one assay ton of solution, silver content: .06764 gr. Platinum electrodes; Amperes 3; Volts 40. Silver precipitated as follows:—

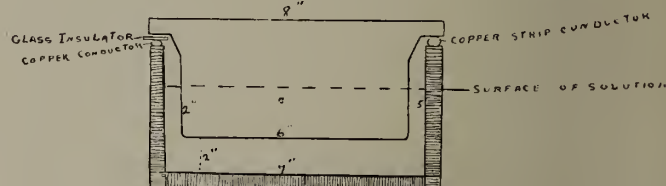
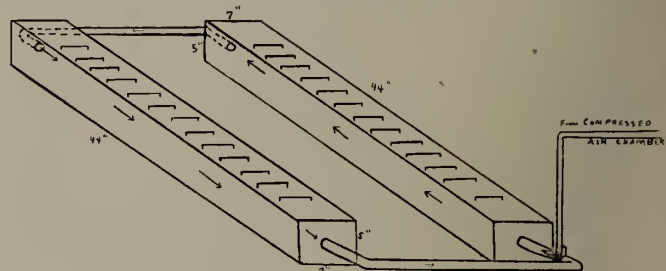
Time	Cathode Wt.	Plated	Total.
Start	26.2908		
5 min.	26.3329	.0421	.0421
12 min.	26.3563	.0234	.0655
17 min.	26.3615	.0052	.0707
20 min.	26.3635	.0020	.0727
25 min.	26.3650	.0015	.0742

The solution was free from silver in 25 minutes. The metal on cathode was dissolved with nitric acid and the silver was precipitated with hydrochloric acid. The cobalt and nickel were replated and weighed .0058 gr., making the total silver deposited .0742—.0058=.0684.

The above examples were taken from a large number of tests showing that the silver could be rapidly and completely precipitated from solution.

In order to give the electrolytic precipitation a thorough test an apparatus consisting of two troughs 44 in. by 7 in. by 5 in. and holding 45 to 50 litres of solution was constructed. These troughs were connected at each end by means of a 2 in. pipe, so that the solution could be circulated, which was accomplished by introducing an air blast into the connecting pipes. Preliminary

work with electrodes showed that lead anodes and tin-plate cathodes gave satisfactory results. Tin-



Precipitating Apparatus

plate seemed to have no reaction with the solution and was easily cleaned. The 12 tin-plate cathodes used in the following experiments weighed 583 gr. before and after using. There were 6 tin-plate cathodes and 7 lead anodes in each trough. These electrodes were all the same size and the surface in contact with the solution was 2 in. by 6 in. or 24 square in. per electrode and 1 square ft. in each trough.

A few preliminary tests were made with this apparatus to determine how fast the silver could be precipitated.

The result of a 26 hour run, showing the amount of silver still in solution at different times is shown below:—

Time.	Assay.
Start	68.08 oz. per ton.
4 hrs.	32.87 " " "
8 hrs.	25.48 " " "
14 hrs.	8.00 " " "
17 hrs.	1.78 " " "
20 hrs.	0.72 " " "
23 hrs.	0.65 " " "
26 hrs.	0.41 " " "

Starting with green speiss a complete quantitative experiment was made to determine how much of the silver contained therein could be recovered as bullion. 10,000 gr. of green speiss was chloridized and leached with cyanide solution. The solution was treated in the precipitating apparatus, described above, and the precipitate was collected, dried, fused with borax, sand and soda which gave a bullion about 900 fine. Complete figures are given in Table No. 2. All weights in this table are grams and the assays of silver are given in per cent. instead of ounces per ton.

At the finish of the experiment a clean-up of the troughs produced 456 grams of dried precipitate and sediment. This was fused with borax, sand and soda and gave 390 grams of silver bullion, which assayed 900.2 fine, making the total fine silver produced 351.8 gr. or 93.91 per cent. of the silver in the original green speiss.

TABLE NO. 1

SHOWING WEIGHTS AND ASSAYS, BEFORE AND AFTER LEACHING, AND CONSUMPTION OF CYANIDE.

No.	WEIGHT		Time	Assay		Ag. Content		Silver Ex- tr't'd	% Ag. Extr't'd	Assay Co. Ni. Con.		Metallic Co. Ni.		Co. Ni Ext.	% Co. Ni Ext.	% CYANIDE			
	Before	After		Before	Aft.	Before	Aft.			Before	After	Before	Aft.			Before	After	Consumed	Ratio
1	2000	1660	10 h	709	13	709	11	698	98.45	3164	35.13	633	583	50	7.90	2.52	1.45	1.07	2.45
2	2000	1695	10 h	898	36.6	898	31	867	96.98	2889	32.43	578	550	28	4.84	2.52	1.30	1.22	2.25
3	2000	1675	10 h	927	34.	927	28	899	96.98	2798	31.74	560	532	28	5.00	2.52	0.76	1.76	3.13
4	2000	1712	10 h	908.4	28.4	908	24	884	97.35	2834	30.79	567	527	40	7.05	2.54	0.83	1.71	3.09
	Av. .	1685			28.0				97.44						6.20			1.44	2.73
	Loss in Wgt. 15.75%																		
1	2000	1605	10 h	1100	19.4	1100	16	1084	98.54	25.82	29.99	516	481	35	6.78	3.20	0.94	2.26	3.33
2	2000	1596	11 h	776	19.4	776	15	761	98.07	26.22	30.77	524	491	33	6.29	3.20	0.91	2.29	4.81
3	2000	1632	11 h	812	17.4	812	14	798	98.27	27.26	30.64	545	500	45	8.25	3.00	0.84	2.16	4.33
4	2000	1582	10 h	773	11.4	773	9	764	98.83	26.93	30.85	539	488	51	9.46	3.20	0.80	2.40	5.02
	Av. .	1604			16.8				98.40						7.70			2.28	4.37
	Loss in Wgt. 19.80%																		

TABLE NO. 2
CHLORIDIZING ROAST

Weight	ASSAY				METALLIC CONTENT					
	Ag.	Co.	Ni.	As.	Fe.	Silver	Cobalt	Nickel	Arsenic	Iron
BEFORE ROAST										
10000	3.746%	24.40	14.39	31.45	17.90	374.6	2440	1439	3145	1790
AFTER ROAST										
13025	2.80%	17.77	10.87	16.65	13.10	364.7	2315	1416	2169	1706
CLINKER, FLUE DUST, ETC.										
1146	0.565%					6.5				
Total.....						371.2	2315	1416	2169	1706
Loss.....						3.4	125	23	976	84
100 gr.	Sample of Chloridized Speiss out.									
100 "	2.80					2.8				

CYANIDE LEACHING

BEFORE LEACH										
12925	2.80%	17.77	10.87	16.65	13.10	361.9	2297	1405	2152	1693
AFTER LEACH										
10744	0.0603%	19.71	12.21	19.70	15.05	6.5	2118	1312	2117	1617
Weight of Metals in Solution.....						355.4	179	93	35	76
Per cent. of Metals in Solution.....						98.20	7.79	6.62	1.62	4.46

Strength of Cyanide Solution before 2.30

After..... 0.25

Consumed..... 2.05.

Rates of Avoirdupois ounces Key. consumed to Troy ounces Silver precipitated 4.08.

Weight of Solution	Silver Assay		Silver Content		Amperes	Volts	Time	Ampere Hours	Silver	
	Before	After	Before	After					Precipit.	Fine Sil.
45477	0.241%	0.00003%	109.6	0.013	3	56	39 hrs.	117	By differ	From
44500	0.247%	0.00024%	109.9	0.094	3	56	44 hrs.	132	355.0 dri.	ppt. fus
50021	0.271%	0.00048%	135.5	0.244	3	56	56 hrs.	141	0.4 with Bor.	etc.
			355.0	0.351					390	354.6
										351.8

SILVER DISTRIBUTION.

Fine Silver obtained as Bullion.....	351.8	93.91%
Clinker, Flue Dust, etc.....	6.5	1.74%
Roasting Loss.....	3.4	0.91%
Tailings.....	6.5	1.74%
100 gr. sample.....	2.8	0.74
Refining bullion and unaccounted for.....	3.6	0.96%
374.6		100.00%

THE EXPORT OF NICKEL MATTE

Ottawa, March 1.—The budget debate concluded early this morning without a vote after seven speeches had been added to the record. The main topic of discussion, as it proved, was not the budget but the export of Canadian nickel and the question as to whether or not any of it found its way to Germany. Several speakers during the course of the debate have urged that it did and the last night they found a champion on the Government side in the person of Mr. W. F. Maclean, of South York, who urged Government control of Canada's nickel deposits and asserted his distrust of the International Nickel Company of the United States, which now refines the great bulk of Canadian nickel.

Hon. Arthur Meighen, solicitor-general, defended the Government's record in connection with nickel export. He stated that after an examination of the books of the International Nickel Company by a Government official it could be stated that not a pound of nickel found its way into German hands and that the price had not been increased to the British Government except by the few cents necessary to cover increased expenses of ocean transportation.

Mr. Meighen said that an arrangement had been made by the Government with the International Nickel Company regarding the exportation of nickel at the close of 1914 and that the papers relating to it had been laid on the table of the house in February, 1915. That arrangement had met with the approval of the British Government which had sent a special note expressing appreciation of the action taken by the Canadian administration in the interest of the Empire.

Mr. Meighen said that he was unable to give the details of the arrangement which had been made because if he did so he would be disregarding the expressed wish of the British Government and making public confidential information. He read the correspondence with regard to the arrangement between Sir Robert Borden and Sir George Perley. Sir George Perley stated that Sir Francis Hopwood, chairman of the British committee for preventing supplies from reaching the enemy, had pronounced the arrangement perfectly satisfactory. The solicitor-general stated that Mr. Graham Bell, financial controller of the Department of Railways, had had access to the books of the International Company with the friendly consent of the corporation. He had authorized the solicitor-general to state that "not a pound of Canadian nickel had reached Germany since the war began."

Mr. Turriff feared that if the company was selling to Germany it might conceal the fact from a Canadian Government official. Mr. Meighen, however, assured him that the system of inspection would prevent such concealment. He then took up Mr. Turriff's assertion that the Krupps were "big owners" of the International Nickel Company. In the first place Mr. Nesbitt, the Liberal member for North Oxford, had asserted that he knew that no one in Germany had anything to do with the company. He had further said that the company would welcome an inspection of its books to prove that such was the case. Mr. Meighen read a letter from Mr. Bostwick, assistant to the president of the nickel company, to the effect that the Krupps had absolutely no influence in the affairs of the company and that, moreover, only 158 shares of common and 263 shares of preferred stock of the company out of 469,

441 shares in all were held by persons in Germany and Austria.

Mr. Meighen then took up the statement of Mr. Turriff that the International Nickel Company was selling nickel before the war at 25 cents a pound and was now charging the British Government 50 cents a pound. The solicitor-general said that before the war the company was selling nickel to the British Government in large quantities at £160 a ton, or at the rate of exchange then prevailing, at about 34.8 cents a pound. At present it was selling, with the approval of the British Minister of Munitions, at £175 a ton or about 37.2 cents a pound delivered in the United Kingdom. The increase in the price, 2.34 cents a pound, would cover the increase in the cost of freight but would make no provision for any increase in the cost of mining and refining.

Mr. Meighen favored an export duty on nickel matte to encourage the establishment of refineries in Canada if this could be done without exciting the antipathy of our neighbors. But to place such a duty on at this time would be to prevent the supply of nickel for the munitions of war which were being manufactured for the allies in the United States.

CROW'S NEST PASS COAL CO.

The directors of the Crow's Nest Pass Coal Co. met in New York City on February 18 and declared a quarterly dividend of 1½ per cent. (at the rate of 6 per cent. per annum), payable on March 3. For some years, up to 1907, the company paid dividends of ten per cent. per annum; then the dividend distribution dwindled to one per cent., which was paid in 1911, although the company's statement of accounts showed a deficit. Since then there has not been any cash disbursement to shareholders. In 1908 a stock dividend of 66 2-3 per cent. was paid to shareholders.

In 1915 the company worked eight mines at its Coal Creek colliery, near Fernie, and four at its Michel colliery. Coke ovens were operated at both Fernie and Michel. Its gross output of coal was 797,010 long tons, against 778,403 tons in 1914, an increase of 18,706 tons. The quantity of coke made was 239,178 tons, as compared with 199,866 tons in 1914, an increase of 39,312 tons.

The following statement, for which the president of the company was quoted as authority, was published in the Journal on February 15: "During the last three years the Crow's Nest Pass Coal Co. has paid off all its bills and accounts payable, amounting in 1912 to a total of \$1,081,690. The liability on these accounts was reduced to \$811,605 in 1913, to \$498,241 in 1914, and the balance was entirely cleared off in 1915." A further statement quoted was: "Since January 1, 1915, the company has paid off all its indebtedness and it now has a substantial balance at its credit in the bank. All the bonds against its subsidiary companies have been paid, so that there are now no bonds outstanding against any of the companies, nor is there any preferred stock. As far as we can judge, the prospects for the coming year are quite as good as, if not better than, the year just closed."

TECK-HUGHES.

The mill at the Teck-Hughes is nearly ready for operation, and mining operations will be resumed shortly. It is hoped that electric power will be available for operation of the mill; but arrangements have not yet been completed.

DEBATE ON THE PROPOSED WAR TAX

The House of Commons in Committee of Ways and Means on Thursday, March 2, 1916, discussed the proposed war taxation. The following extracts from the official report of the debate are of interest to mining men:

Sir Thomas White (Minister of Finance): The resolutions which were brought down in the Budget appear in the Votes and Proceedings of February 15. In the course of the debate on the Budget, I stated that I would acquaint the House with certain provisions which appear in the Bill to be founded upon the resolutions dealing with some important matters which were discussed in the course of the debate. I propose at this sitting of the committee, to deal briefly with these points and with the amendments which I have to offer; and then I will ask the Committee to rise and report progress. The resolutions can then be printed, and to-morrow or some later day, with the full text of the resolutions and amendments before it I will ask the committee to proceed with their consideration.

In the resolutions it was provided that the special taxation measure should apply to the accounting periods ending after August 4, 1914, of persons, firms, partnerships and companies. The intention of the proposals was, that no business should pay upon more than three accounting periods, or upon less than three accounting periods, of one year each.

The proposal to make the taxation apply to the past has been discussed at some length, and, so far as the revenue of the Dominion is concerned, I think it makes no difference—as only three periods can be taxed, and as three periods must be taxed—whether or not the proposals are limited to accounting periods which fall in after August 4, provided that the accounting periods are dealt with. This, however, is subject to two considerations. In the first place, large profits were derived during 1915 by many firms and companies engaged in the munitions business and in many other businesses in which, owing to the war, there was an abnormal rise in the price of the commodities dealt with. Secondly, there is this consideration: that it is not desirable, as this measure is a temporary one, to extend its provisions too far into the future. In view of the discussion which has taken place, and having given the matter full consideration, the Government is of the view that the measure might with fairness be made to apply to businesses in respect of accounting periods which end after December 31, 1914, instead of after August 4, 1914. The months of August, September, October and November, after the outbreak of the war, were very trying months; and, therefore, I have to propose, in the amendments which I shall lay upon the table, that the taxation measure shall apply to businesses in respect of accounting periods which end after December 31, 1914.

Mr. Murphy: How far does the explanation that the hon. gentleman has just given apply to the accounting period which, under the resolution, is to be determined by the minister himself?

Sir Thomas White: As my hon. friend will observe, the discretion of the minister to determine the accounting period applies only to cases where the accounting period exceeds a year, or where there is no accounting period. I do not think that occasion will arise frequently for the exercise of that discretion. It is only to safeguard the measure, so that companies cannot

evade the tax by saying: we have no accounting period. As a corollary to what I have stated, namely, that the new proposals will apply to accounting periods ending after December 31, 1914, the operative part of the Bill will come to an end on December 31, 1917, instead of August 3, 1917, in order that the measure may apply to three accounting periods of a year, and to not more than three accounting periods a year.

Mr. Graham: You will get more money, too.

Sir Thomas White: I am glad to hear my hon. friend say that. I am trying to meet the difficulty that has been mentioned; I am rather disposed to think that my hon. friend is right in suggesting that we shall get more money.

The Bill itself contained provisions, even under the resolutions as drafted, whereby any business subject to the tax would not be obliged, in the year 1916, to pay in respect of two accounting periods. There were provisions in the Bill that, where a business was liable in respect of two accounting periods, representing a period of two years, the business might pay for the first accounting period in 1916, for the second accounting period in 1917, and for the third accounting period in 1918. My object was to avoid inconvenience and hardship to those who might be subject to the taxation in being obliged to pay in 1916 in respect of two full accounting periods.

Turning from the so-called retroactive provisions of the measure to certain other matters which were discussed, and particularly to the question of the capitalization of companies, I have the following observations to make: It is not necessary for me to say to the committee that in an intricate measure of this kind, a measure so far-reaching in its character, it has not been an easy matter to deal with the important question of reserves. The committee, comprising as it does so many lawyers and business men, of course understands that there are reserves and reserves. One company has carried on its business properly. Starting years ago with a small capital, it has written off year by year a proper amount for depreciation. Every year it has put part of its profit back into business, usually into the plant or stock in trade. In a word, it has built up its business along conservative lines. Some of the greatest enterprises in the world have been built up precisely in that way, and in my opinion that is the proper way to build up large industries; that is to say, to grow by certain and sure steps from small beginnings to a larger, and finally to a great business. In cases such as that, where the reserves are true reserves, no question could possibly arise. Such reserves are just as much capital as the paid-up capital of the company, even if it is fully paid up in cash.

Mr. Nesbitt: Does that apply to incorporated companies as well as to partnerships?

Sir Thomas White: Undoubtedly. The question does not arise in the case of firms, because there we are taking the value of their assets.

Mr. Sinclair: What would the minister say as to the value of stock quotations on the exchange? We will say that a stock which has a nominal value of 100 is quoted in the market at 400. Would the minister say that that was a fair way of finding the market price?

Sir Thomas White: I am coming to that, but I will say now, and I think my hon. friend, as a lawyer, will agree with me, that stock market value is evidence, but not conclusive evidence of value. It is some evidence to be taken into consideration. But many factors enter into stock market values—earning power as well

as the tangible assets back of the stock, and while I would be disposed to say to my hon. friend that some regard should be had to stock market quotations, still I would not consider that a sound basis on which to reach the value of any stock listed upon exchange. My hon. friend also knows that stocks fluctuate very much according to financial conditions. When money is cheap, when there is a boom, stocks of course rise in value. On the other hand when panics occur, or money becomes dear, stocks fall in value; so I think it would be very unsafe to take the stock market quotations as the value at which stock should be fixed for the purpose of ascertaining the true capitalization of over-capitalized companies.

Now I come to what I have to propose. I told the House that this taxation measure would apply to businesses, including corporations, in respect to accounting periods ending after December 31, 1914. To meet the case of so-called watered stock corporations, or over-capitalized companies, I propose by way of addition or amendment to the resolutions a definition of amount paid up on capital stock, which I think will fairly meet the situation. I say again, perhaps quite unnecessarily, that it is not an easy situation to deal with, because we have behind us the entire legislation of the past, and corporate action in virtue of that legislation, and decisions thereunder.

What I propose is as follows: That the amount paid on the capital stock of a company shall be the amount paid up in cash. That is to say, if paid up in cash, no question arises. Where stock was issued before the first day of January, 1915, for any consideration other than cash, the fair value of such stock, on such date, shall be deemed to be the amount paid up on such stock; and where stock has been issued since the first day of January for any consideration other than cash, the fair value of the stock at the date of its issue shall be deemed to be the amount paid up on such stock. In estimating the value of stock issued for any consideration other than cash, regard should be had to the value of the assets, real and personal, movable and immovable, and to the liabilities of the company at the date as of which such value is to be determined.

In no case shall the value of the stock be fixed at an amount exceeding the par value of such stock. In other words, what we propose is that where stock has been issued for cash, the amount paid upon the stock shall be the amount of cash so paid upon the stock, but not of course exceeding par. Where the amount paid exceeds par, that would appear in the reserves of the company, so that no injustice is done in making the limitation par. Where the stock of a company has been issued, for consideration other than cash, prior to January 1, 1915, we propose to say that the amount paid up on the stock for the purposes of this Act is the fair value of that stock as at January 1, 1915. Why? Because, as I have said before, this is a tax upon profits upon capital, if we can determine the capital of the company as of a date approximating the beginning of the period in respect to which the company is taxed. then we are fairly imposing the tax in respect to the capital of the company at that time. In other words, we are dealing with the over-capitalized company on precisely the same basis as we are dealing with the properly capitalized company.

Mr. W. F. Maclean: And the hon. gentleman de-waters some of the stock?

Sir Thomas White: We de-water some of the stock for the purposes of this Act. I did not know that my

hon. friend knew what watered stock was. That is the proposal which the Government has to make in respect to companies whose stock has been issued for consideration other than cash. I realize that it will not be possible to ascertain the precise cash value, but for every practical purpose of the Act, this puts the over-capitalized company upon exactly the same basis as the company which has been properly capitalized.

Sir Wilfrid Laurier: How will you determine what is water and what is gold?

Sir Thomas White: No doubt my hon. friend uses the word "gold" in the sense of tangible assets?

Sir Wilfrid Laurier: Yes.

Sir Thomas White: Let me give my right hon. friend an illustration such as this: You may have an industrial company whose stock was watered to a very considerable extent, say, some time ago, or, recently—it really makes no difference for the purposes of my argument. That company has certain earnings to-day. Its stock has been issued for a consideration other than cash. If we could determine the value of the assets of that company as of January 1, 1915, and determine the liabilities of that company as of January 1, 1915, we would have a reasonably fair idea of the value of the stock: in other words, of the true capital of the company. My right hon. friend will, no doubt, say that it will be a difficult thing to do, and I quite agree with him, but in connection with assessment, I may say that I had charge of the business assessments in the city of Toronto for ten years, and while a number of questions arise which are difficult of determination, they are not impossible of determination along fair or just lines for purposes of a taxation measure. Personally, I see no difficulty in administering the Act under this provision, and administering it in such a way, as I stated a few days ago to the House, as to allow of no undue advantage to the over-capitalized company.

Mr. Pugsley: It is proposed to take the actual, fair, cash value irrespective of any prospective profits?

Sir Thomas White: What I say is the value of the assets, movable and immovable, real and personal, irrespective of future expected earning power.

Mr. Pugsley: The cash market value?

Sir Thomas White: The cash value? What I say is the value of the assets of the company, real and personal, movable and immovable, adopting the same language as we do in connection with persons and firms subject to taxation, less the liabilities of the company.

Mr. Pugsley: When you say the "fair value," do you allow for prospective profits?

Sir Thomas White: No. I have not used the words "fair value" in respect to the future profits on the stock, but I say that regard should be had to the value of the assets, real and personal, movable and immovable, subject to the liabilities of the company at the date at which such value is to be determined. When the matter is in committee I would value very greatly the opinion of my hon. friend, or any suggestion that he might put forward, but when we say that it is to be the value of the stock as of about the time this Bill begins to operate, and when we say, in reaching that value, that regard shall be had to the value of the assets, real and personal, movable and immovable, and the liabilities of the company, we put the over-capitalized company precisely on the same basis as the fairly capitalized company and the individual who is being taxed by this Bill. That is what we propose to do and that is the intention of this amendment to the resolution.

Mr. W. F. Maclean: Would the minister say who is to apply the law in this case?

Sir Thomas White: We propose to administer this Act through the Finance Department. Just as the customs administration is under the Minister of Customs, just as the administration of the inland revenue is under the Minister of Inland Revenue, so the administration of this Act will be under the Department of Finance, and we shall have to make the assessment and collect the taxation. There will be an appeal to the Board of Referees and a further appeal to the court in order to safeguard the rights of the taxpayer.

Mr. Graham: There are two kinds of securities, namely: bonds and preferred stock, which usually provide the capital in cash. Common stock represents an intangible asset such as goodwill or something of that kind. As I understand it, my hon. friend proposes to treat preferred stock and common stock just as capital stock.

Sir Thomas White: "Capital stock" for the purposes of this Act, is capital stock, whether preferred or common, but bonds, the liability of the company, cannot be regarded as capital stock.

There are carrying on business in Canada some companies who are controlled by companies outside of Canada, and, instead of those companies paying their true net profits, or a substantial part of them by way of dividends to the holding or parent company, they have an arrangement whereby they sell the parent company their product at less than its fair market value and in that way the parent company takes its benefits or advantage from the stockholders in such company. That also is a matter of some difficulty, as hon. gentlemen will realize, but I think I have covered that by an amendment which I shall ask the committee to consider carefully, and which is as follows:

Where an incorporated company conducts its business, whether under agreement or otherwise, in such manner as either directly or indirectly to benefit its shareholders or any of them or any persons directly or indirectly interested in such company by selling its product or the goods and commodities in which it deals at less than the fair price which might be obtained therefor the minister may determine the amount which shall be deemed to be the profits of such company for any accounting period and in determining such amount the minister shall have regard to the fair price which but for any agreement, arrangement or understanding might be or could have been obtained for such product, goods and commodities.

Mr. W. F. Maclean: Would the amendment reach the nickel company—a nickel company? I do not want to specify. Is the minister trying to deal with a company of that kind?

Sir Thomas White: I think that might fairly be gathered from the clause I read. There has been a misunderstanding with regard to the effect of the measure on mining companies, and there is no doubt that mining companies present difficulties that are not presented by other companies. It would in my view be quite unjust to leave mining companies untaxed in a measure such as this. You have in the case of mining companies frequently a capital of five, ten or twenty million dollars earning large profits, and it would seem unfair to other corporations for mining corporations to escape untaxed. Now, it is only fair to the mining corporations, because I have had representations from some of them, to say that they do not in the least degree desire to escape taxation at this time.

They put forward their view as to the method of application of this Act to mining companies. But, as I have said, there has been misapprehension as to the effect of the proposals upon mining conditions. In the case of a mine, profits, so-called, include not only what might be regarded as true net profits, but a very substantial portion of the capital of the mine. Therefore, when we assess mining companies, we must bear in mind that, in order to ascertain what their net profits are, a substantial part of the apparent profits of the mine represent capital, and that within a few years, depending upon the character of the mine, whether metalliferous or otherwise, the capital will be exhausted. Under the laws of the Province of Ontario, and possibly under those of some other provinces, a mining corporation is permitted to do what another corporation is not permitted to do—namely, to pay out as profits to its shareholders a part of the capital. Now, under the resolutions as they stand, it is perfectly clear that in determining the net profits, regard must be had to the amount by which the mine is yearly exhausted. I may say, there is legislation in the United States assessing the income of mining companies, and it is provided that allowance shall be made, not exceeding a certain percentage—I have forgotten the exact figure—to represent the capital that is being returned to the shareholders in the so-called profit distribution. Now, although it would be implied by the resolutions as they stand, that this allowance should be made for the depletion of capital, yet, in order to make it perfectly clear, **I propose to provide that the minister, in determining the profits derived from a mine, may make an allowance for the exhaustion of the mine.**

Sir Wilfrid Laurier: My right hon. friend said that in the case of mining companies the minister would be allowed to make a deduction upon the amount the companies are assessed. Will provision be made in the Bill authorizing the minister to make that deduction, and will any limitation be set?

Sir Thomas White: I gave that matter very careful consideration, and finally came to the conclusion that it would be unwise to import any limitation, and I will tell my right hon. friend why. In the legislation of the United States respecting mining companies, there is a limitation beyond which an allowance cannot be made. An allowance may be made for exhaustion of a mine, but the allowance must not exceed 5 per cent., I think it is, of the output of the mine. I regard it inexpedient to fix a limitation for this reason. Mines are of different character. You may have a coal mine that will last for generations, and silver and gold mines which will last for varying periods. You cannot lay down any hard and fast rule in regard to all mines. It would seem to me that the facts in connection with each particular mine should be taken into consideration at the time the assessment is made; such facts, for instance, as the district in which the mine is, the condition of the mine, etc., and then try and reach a just conclusion as to how much should be allowed as capital. My right. hon. friend might properly observe that that leaves a great deal to discretion, and I agree that it does. I think it advisable in all legislation, whether taxation or otherwise, that the law should be clear in so far as it is possible to make it clear, and that as little room as possible should be left for the exercise of discretion; but in all legislation, and especially in taxation legislation, a certain amount of discretion is necessary in the administration of the Act. I do not mean a discretion which

would favor one and do an injustice to another; but a certain amount of discretion must be exercised by the officials who carry out the Act. They may say: In this particular mine or industry we estimate that an allowance of such and such per cent. should be made for exhaustion of capital. It might be better to deal with this matter—and I have given this some consideration—by regulations of the Governor in Council, and I shall be very glad to consider any such suggestions when we are in committee again, and in the meantime my hon. friends may think the matter over with a view to offering suggestions that they think would improve the Bill.

INTERNATIONAL NICKEL CO.

Under date of March 1st, the Boston News Bureau says: One of the most absurd yarns published since beginning of the European war is the one from Canada that International Nickel Co. is controlled by German-Americans and is shipping nickel to Germany. For this reason J. G. Turriff, a western liberal member of parliament, wishes to stop the exportation of nickel from Canada.

In this connection it is interesting to note that E. C. Converse, Ambrose Monell, W. E. Corey, D. Coulson, W. T. Graham, Robert M. Thompson, J. R. De Lamar, and a few other good "Germans" control the International Nickel Co.

Corey, Monell and Converse are among the controlling interests of Midvale Steel Co., which is filling big orders for Great Britain and France. They are also identified with big interests who are supplying copper and steel to the allies. The companies with which they are identified are among the largest consumers of nickel. The question is where would the American manufacturer procure nickel for British war orders if supplies from Canada were shut off?

The statement that large quantities of nickel are being exported to Germany is given no credence. It is true, however, that over the past several weeks a big borrowing demand for International Nickel stock has developed.

Officials of International Nickel Co. deny flatfootedly the statements regarding the company made on floor of House of Commons at Ottawa by a western member.

The denial by International Nickel officials is explicit.

There is no foreign control of the company. Less than 500 shares of Nickel stock are owned in Germany and Austria.

Inasmuch as the allies have declared nickel contraband of war, it is impossible for the metal to reach Germany and Austria.

Price to the British government is a shade less than the company received before the war.

In view of announced intention of International Nickel Co. to construct a refinery in Canada with capacity sufficient to meet needs in nickel of the Dominion and Great Britain, and acceptances of that plan by the Canadian government as satisfactory, the attack in parliament made by a western member of the opposition is not regarded here as important. It appears to be strictly a political speech. At request of the Nickel Co., the Canadian government sends a representative to New York each month, to check up the company's books and this monthly scrutiny has borne out the company's assertions that none of the company's products is reaching the enemy. Canadian government has expressed itself as satisfied with the reports.

SOUTHERN YUKON.

A letter to the Whitehorse Star from Robinson Station, 22 miles south of Whitehorse, Southern Yukon, tells of considerable activity there in mining circles. James Powell has bonded for \$20,000 six antimony claims from Cochrane and Becker; also two antimony claims from Becker and Patterson (the consideration in the latter deal being \$16,000), these two claims being situated on what is known as Chieftain hill. From Adam Birnie, Powell purchased the View mineral claim outright for \$5,000. On these various properties work was to be begun about March 1 with 18 to 25 men employed.

The Daily Alaskan, published at Skagway, on February 12, printed information relative to a resumption of work at the Pueblo mine, in Whitehorse copper camp, as follows: Snow, ice, dirt, and supplies have been moving at the Pueblo mine since the return recently of General Manager W. D. Greenough. Roads have been shoveled, tracks cleared, roofs cleaned, frozen pipes dug up, supplies brought in—the preliminary work of opening the mine. Work at the compressor reached the stage on February 7 where water could be turned into the boilers. As soon as the boilers get up steam the work of unwatering the mine will be commenced. The cabins are being overhauled and furnished.

On February 8 the whistle of the railway locomotive was heard at the Pueblo for the first time for fifteen months. Supt. V. I. Hahn, who had directed the work of clearing and repairing the railway track, accompanied the train crew on the first trip. He reported several hard-packed, badly-drifted places along the track. For four days as many workmen as could be mustered in Whitehorse were kept busy shoveling away tons of drifted snow and chopping through at least 1,800 ft. of ice which extended like a glacier, sometimes four or five feet thick, along the track. The process was exceedingly slow, and not until noon of February 8th did the first locomotive get all the way to the Pueblo. Since then several carloads of freight have been hauled out to the mine.

From another source it is learned that the holdings of the Atlas Mining Company have been taken over by the Yukon Copper Company, a Canadian company organized by Dr. Alfred Thompson, M.P., for Yukon Territory, Mr. Wilbur D. Greenough, and associates. Dr. Thompson is president and Mr. Greenough vice-president and general manager of the company; the latter will have immediate charge of operations at the Pueblo mine. Shipment of ore is to be resumed as soon as the mine is again in shape for producing, and it is expected a large quantity will be shipped during the ensuing season.

A report has been received from the Chisana (Alaska) field, across the International Boundary line from the Canadian Yukon, to the effect that between \$100,000 and \$150,000 worth of gold was obtained there last season. About 50 men remained in Chisana district for the winter; 10 were at Chisana City, 10 at the mouth of Bonanza, and the remainder were scattered along various creeks in the district. More winter mining has been done in the 1915-1916 winter than ever before, and considerable drifting was undertaken.

KEORA.

A contract has been let for the sinking of a 200-ft. shaft on the Keora property in Whitney Township.

MINERAL PRODUCTION OF CANADA IN 1915

A PRELIMINARY REPORT

By John McLeish, Mines Branch, Ottawa.

As a result of the demand created by the war, the metal mining industry has, in 1915, shown the highest production ever recorded and notwithstanding the greatly decreased production of materials of construction, such as cement, clay and stone quarry products, a very large increase is still shown in the total mineral output, over that of the previous year.

The production in 1915 was as follows:—

Metallic.

Product.	Quantity.	Value.
Antimony, lb.	961,040	\$192,208
Cobalt, metallic, lb.	211,610	
Cobalt, oxide, lb.	379,219	502,388
Copper, valued at 17.275c. per lb.	55,325	
Nickel, metallic, lb.	200,032	42,193
Nickel, oxide, lb.	102,612,486	17,726,307
Gold, oz.	916,076	18,936,971
Iron pig from Canadian ore, tons	158,598	1,740,808
Iron ore sold for export, tons	93,444	187,682
Lead, valued at 5.60c. per pound, lb.	45,377,065	2,541,116
Molybdenite, lb.	28,600	28,460
Nickel, valued at 30c. per pound, lb.	68,077,828	20,423,348
Silver, valued at 49.604c. per pound, oz.	28,401,735	14,088,397
Zinc ore, tons	15,553	636,204
Total		\$77,046,082

Non-Metallic.

Product.	Quantity.	Value.
Actinolite, tons	220	\$2,420
Arsenic, white, tons	2,291	141,830
Asbestos, tons	113,115	3,491,450
Asbestic, tons	25,700	21,819
Chromite (a), tons	11,486	162,618
Coal, tons	13,209,371	31,957,757
Corundum, tons	262	33,138
Feldspar, tons	15,455	59,124
Graphite, tons	2,610	121,023
Grindstones, tons	2,580	35,768
Gypsum, tons	470,335	849,928
Magnesite, tons	14,779	126,535
Manganese (b), tons	47	5,460
Mica		81,021
Mineral Pigments—		
Barytes, tons	550	6,875
Ochres, tons	6,248	48,353
Mineral water		118,796
Natural gas, M. cu. ft.	18,319,710	3,300,825
Product.	Quantity.	Value.
Petroleum, value at \$1.395 per barrel, bbls.	215,464	300,572
Phosphate, tons	217	2,502
Pyrites, tons	296,910	1,028,678
Quartz, tons	127,108	205,153
Salt, tons	119,900	600,226

Talc, tons	11,885	40,554
Tripolite, tons	317	12,119

Total \$42,755,594

Structural Materials and Clay Products—

Cement, Portland, bbls.	5,681,032	\$6,977,024
Clay products—		
Brick, common, pressed, paving		2,341,483
Sewer pipe		795,646
Fireclay, drain tile, pottery, etc.		781,071
Kaolin, tons	1,300	13,000
Lime, bushels	4,932,767	1,015,878
Sand and gravel		2,098,683
Sand-lime brick, No.	23,211,802	182,651
Slate, sq.	397	2,039
Stone—		
Granite		1,634,084
Limestone		2,504,731
Marble and Sandstone		365,784

Total structural materials and clay products	\$18,712,074
All other non-metallic	42,755,594
Total value, metallic	77,046,082

Grand total, 1915 \$138,513,750

(a) Additional returns make the Chromite production 14,291 tons, value \$208,718; (b) Exports are reported as 255 tons, valued at \$6,855.

The total value* of the metal and mineral production in 1915, as shown in the preliminary report presented herein, was \$138,513,750, compared with \$128,863,075 in 1914, and \$145,634,812 in 1913, the latter being the highest production recorded. The increase in 1915 over 1914 was thus \$9,650,675, or 7.49 per cent., but the output is still less than that in 1913 by \$7,121,062.

Without attempting to discuss at length the effect of the war upon the Canadian mining industry, it may be remarked that the demand for the metals, copper, lead, nickel and zinc, led to great activity in the operation of the already developed deposits of these metals, and also, later in the year, to the opening up of old and the exploitation of new deposits. The capacities of steel furnaces were taxed to the utmost to meet the demand for shell steel.

The fact that under war conditions it was desirable that our metals should become available for commercial or national use, entirely within the country and that we should be less dependent, even upon a friendly neutral, for their recovery in smelters and refineries has stimulated the development of our smelting and refining operations.

Amongst non-metallic minerals the recovery of benzol and toluol in by-product coke oven operations was a direct result of the war, as was also the activity in the mining and shipment of magnesite and of chrome ores.

*In presenting a total valuation of the mineral production as is here given, it should be explained that the production of the metals copper, gold, lead, nickel and silver is given as far as possible on the basis of the quantities of metals recovered in smelters, and the total quantities in each case are valued at the average market price of the refined metal in a recognized market. There is thus included in some cases the values that have accrued in the smelting or refining of metals outside of Canada.

The limitation placed by the Government upon the export of certain minerals and metals may have caused inconvenience and interruption to certain industries but these were usually adjusted by the issue of special licenses for export where it could be shown that such export was not for enemy destination but was in the interest of Great Britain and her allies.

The mining and metallurgical industries include a great variety of products so that in dealing with the industry as a whole the total value presents the only means of comparison, nevertheless quantities of production and prices are at all times the items of essential importance.

A comparison of the production of the more important mineral products in 1915 with that of 1914, is shown in the accompanying table.

Increase or Decrease in Principal Products, 1915.

Principal Products.	Quantity.	Pct.	Value.	Pct.
Copper, lb.	*26,876,526	35.49	*\$7,424,701	72.07
Gold, oz.	*142,893	18.48	*2,953,964	18.48
Pig iron, tons	*130,555	16.67	*1,589,963	15.90
Lead, lb.	*9,039,300	24.88	*914,548	56.19
Nickel, lb.	*22,559,886	49.56	*6,767,967	49.56
Silver, oz.	†48,086	0.17	†1,505,234	9.65
Total metallic			*\$17,659,463	29.73
Asbestos & Asbestic, tons	*21,242	18.07	*603,463	20.74
Coal, tons	†428,153	3.14	†1,514,044	4.52
Gypsum, tons	†46,545	9.90	†306,279	26.49
Natural gas, M. ft.	†3,372,794	15.09	†183,902	5.28
Petroleum, brls.	*659	0.31	†42,552	12.40
Pyrites, tons.	*68,596	30.04	*284,170	38.16
Salt, tons	*12,862	12.02	*106,578	21.59
Cement, brls.	†1,491,448	20.79	†2,210,900	24.06
Clay products			†2,940,757	32.01
Lime, bush.	†2,095,815	28.92	†344,750	33.94
Sand and Gravel			†406,628	16.23
Stone			†964,457	17.63
Total non-metallic			†\$8,008,788	11.53
Grand total			*9,650,675	7.49

*Increase. †Decrease.

It will be observed that there has been an increased production in all metals with the exception of silver. The total value of the metallic production in 1915 was \$77,046,082, as compared with \$59,386,619 in 1914, and \$66,361,351 in 1913, the increase over 1914 being nearly 30 per cent., and that over 1913 the highest previous year, about 16 per cent. The production of nickel, copper and zinc are the highest that have been re-

paratively recent years except possibly in antimony and zinc, and some of the rarer metals.

Compared with 1914 the average price of copper shows an increase of 27 per cent., lead an increase of 27 per cent., spelter an increase of 154 per cent., antimony (ordinaries) an increase of 246 per cent., silver a decrease of 9.4 per cent., and tin an increase of 12.2 per cent.

The total value of the non-metallic production in 1915 including clay and quarry products, etc., was \$61,467,668 as against \$69,476,456 in 1914; \$79,273,461 in 1913. Compared with 1914 the decrease was \$8,008,788, or 11.5 per cent., while compared with 1913 the falling off was \$17,805,793 or 22.5 per cent.

It will be seen that the largest decreases in 1915 occurred in materials of construction such as cement, clay products, lime, sand and gravel, and stone and quarry products, the falling off varying from 16 to nearly 34 per cent. There was, however, also a smaller production of coal, natural gas and gypsum. On the other hand there were increases in the shipments of asbestos, chromite, graphite, magnesite, pyrites and salt.

The record of mineral production by provinces shows the relative importance of the provinces in the same order as in the previous year with the exception that Quebec and Alberta change places, the former having the larger production in 1915. An increase in production is shown in the provinces of Nova Scotia, Quebec, Ontario, and British Columbia, and a decrease in New Brunswick, Manitoba, Saskatchewan, Alberta and the Yukon district. Ontario again has the largest output with a value of \$61,800,170, or 44.6 per cent. of the total, and showing an increase over 1914 of \$8,765,501, or 16.5 per cent. British Columbia occupies second place with a value of \$28,932,658, or 20.9 per cent. of the total and showing an increase of \$4,768,619, or 19.7 per cent. over 1914; Nova Scotia is third with a production valued at \$18,126,672, or 13.1 per cent. of the total and showing an increase of \$542,033, or 3.1 per cent. over 1914. Quebec comes fourth with a value of \$12,159,436, or 8.8 per cent. of the total, and an increase over 1914 of \$322,507, or 2.7 per cent. Alberta occupies fifth place with a production of \$9,915,282, or 7.2 per cent. of the total and showing a decrease of \$2,768,952, or 21.8 per cent. compared with 1914. The Yukon district mineral production, includ-

Metal Prices.

	1910.	1911.	1912.	1913.	1914.	1915.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Antimony (ordinaries), per lb.	7.386	7.540	7.760	7.520	8.763	30.280
Copper, New York, per lb.	12.738	12.376	16.341	15.269	13.602	17.275
Lead, New York, per lb.	4.446	4.420	4.471	4.370	3.862	4.673
Lead, London, per lb.	2.807	3.035	3.895	4.072	4.146	4.979
*Lead, Montreal, per lb.	3.246	3.480	4.467	4.659	4.479	5.600
Nickel, New York, per lb.	40.000	40.000	40.000	40.000	40.000	45.000
Silver, New York, per oz.	53.486	53.304	60.835	59.791	54.811	49.684
Spelter, New York, per lb.	5.520	5.758	6.943	5.648	5.213	13.230
Tin, per lb.	34.123	42.281	46.096	44.252	34.301	38.500

*Prices quoted by James Robertson Co.

corded in these metals. The quantity of nickel was 50 per cent. greater than in 1914, copper over 35 per cent. greater, lead nearly 25 per cent. greater, gold over 18 per cent. and pig iron nearly 17 per cent. The falling off in silver was only 48,000 oz. or less than two-tenths of one per cent. Owing to the high prices of copper and lead the total values of these metals show increases of 72 per cent. and 56 per cent. respectively.

Although the prices of nearly all metals have been high they have in most cases been exceeded in com-

ing copper and coal as well as gold, is sixth, with a value of \$4,915,863, or 3.6 per cent. of the total and a falling off from 1914 of \$502,322, or 9.3 per cent. Manitoba's production was \$1,351,604, a falling off of \$1,061,885, or 44 per cent. New Brunswick's production was \$916,329, a decrease of \$98,241, or 9.7 per cent., and the production of Saskatchewan was the smallest, being \$395,728 or less than that of 1914 by \$316,585, or 44.4 per cent.

Mineral Production by Provinces, 1914 and 1915.

	1914		1915			Pct.
	Value of production.	Per cent. of total.	Value of production.	Per cent. of total.		
Nova Scotia	\$17,584,639	13.68	\$18,126,672	13.09	*\$542,032	3.08
New Brunswick	1,014,570	0.79	916,329	0.66	†98,241	9.68
Quebec	11,836,929	9.21	12,159,436	8.78	*\$22,507	2.72
Ontario	53,034,677	41.01	61,800,178	44.62	*8,765,501	16.53
Manitoba	2,413,489	1.88	1,351,604	0.97	†1,061,885	44.00
Saskatchewan	712,313	0.55	395,728	0.28	†316,585	44.44
Alberta	12,684,234	9.87	9,915,282	7.16	†2,768,952	21.83
British Columbia	24,164,039	18.80	28,932,658	20.89	*4,768,619	19.73
Yukon	5,418,185	4.21	4,915,863	3.55	†502,322	9.27
Dominion	\$128,863,075	100.00	\$138,513,750	100.00	*\$9,650,675	7.49

*Increase. †Decrease.

Gold.

The total production of gold in placer and mill bullion and in smelter products in 1915 is estimated at 916,076 fine ounces valued at 18,936,971, as compared with 773,178 fine ounces valued at \$15,983,007 in 1914, an increase of \$2,953,964 or 18.5 per cent. Although the production has more than doubled since 1907 it has not yet reached the high mark attained during Klondike's best years. The 1915 output was exceeded during each of the four years from 1899 to 1902.

Of the total production in 1915 about \$5,550,987 was derived from placer and alluvial mining, \$9,195,307 in bullion and refined gold and \$4,230,677 contained in matte, blister copper, residues and ores exported.

The production in Nova Scotia was about \$137,178, or over twice the output of the previous year. The pyrites ores of Quebec carry small quantities of gold and silver though the producers are not paid therefor. No placer recovery was reported from this province.

Ontario has now become the largest gold-producing province in Canada, the production in 1915 from fifteen properties being reported as \$8,386,956, or 44 per cent of the total production in Canada, as against a production in 1914 of \$5,545,509, an increase of \$2,841,447, or 51 per cent. The Hollinger and Acome mines contributed about one-half of the output in 1915 and the Dome nearly one-fifth of the total.

No production of gold has been reported in either Manitoba or Saskatchewan although some development work has been done. From Alberta record has been obtained of the recovery of about \$4,000 of alluvial gold.

The production in British Columbia was \$5,628,982 including \$755,000 estimated by the provincial mineralogist as being the output of placer workings, and \$4,873,982 recovered from milling and smelting ores. In 1914 the production was \$5,224,393, including \$565,000 from placer workings and \$4,659,393 from milling and smelting ores.

The Yukon production in 1915, including a small recovery from copper ores, was \$4,755,721, a decrease of \$369,653 from the 1914 production. The amount of gold on which royalty was paid during the year 1915 according to the records of the Mining Lands and Yukon Branch, Interior Department, was 287,254.15 oz., as against 309,691.17 oz. in 1914, and 352,900.04 oz. in 1913. For purposes of the royalty this gold is valued at \$15 per oz., although the actual value is probably nearer \$16.50. The receipts at the Dominion of Canada Assay Office, Vancouver, were 87,284.35 oz., valued at \$1,421,292.37, or an average of \$16.28 per oz.

The exports of gold bearing dust, nuggets, gold in ore, etc., in 1915, are reported by the Customs Department as \$16,528,143.

Silver.

The production of silver was 28,401,735 oz., valued at \$14,088,397 as against 28,449,821 oz. in 1914, valued at \$15,593,630. Silver is the principal metal that did not show an increased production in 1915. The falling off in quantity was very small, however, amounting to only 48,086 oz. Owing to the lower price of silver the decrease in total value was \$1,505,234 or over 9.6 per cent.

Of the total production in 1915, 24,653,057 oz., or about 86.8 per cent. is credited to Ontario.

The production from the ores of Cobalt and other silver camps was 23,568,147 oz., including 19,893,639 oz. in bullion recovered in smelters and cyanide plants in Canada and 3,674,508 oz. estimated as recovered from ores exported to United States smelters. The quantity credited to gold ores was 84,910 oz. The total production in 1914 was estimated at 25,139,214, compared with which the 1915 recovery shows a decrease of 1,571,067 oz.

Of the silver in bullion 10,623,307 oz. were produced in smelters in Southern Ontario, and 9,270,332 oz. in the mills at Cobalt, the total in bullion being over 84 per cent. of the production of the district.

The production in British Columbia, representing refined silver, silver contained in smelter products, and estimated recoveries from ores exported, was in 1915, about 3,628,727 oz. as compared with 3,159,897 oz. in 1914, an increase of 468,830 oz., or over 14 per cent.

In Quebec province there is a small silver content in the pyrites ores shipped, while in the Yukon 58,382 oz. are estimated as being contained in the placer gold produced and recovered from copper ores.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department, were: 27,672,481 oz. valued at \$13,812,038.

The price of silver in New York varied between a minimum of 46¼ cents in September and a maximum of 56 cents in December, averaging for the year 49.684 cents, a decrease of 5.127 cents from the average price in 1914.

Copper.

The copper output in 1915 was the highest recorded. The production in smelters together with the estimated recoveries or amounts paid for in ores exported amounted to 102,612,486 pounds, which at the average New York value of refined copper would be worth \$17,726,307. The highest previous production was in 1912 when an output of 77,832,127 pounds was reached. Compared with the production in 1914 which was 75,735,960 pounds valued at \$10,301,606 an increase is shown of 26,876,526 pounds or 35 per cent., and in total value of \$7,424,701, or 72 per cent.

Of the total 1915 production 42,050,347 pounds were contained in blister copper, 44,230,052 in copper and

copper nickel matte and 16,332,087 recovered from ores exported.

The production in Quebec from pyrites ores was 6,982,003 pounds as against 4,201,497 pounds in 1914.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine, although there is a small amount of copper contained in the silver ores shipped from Cobalt, some of which is paid for. There was also a small shipment from the old Massey mine which was reopened during the year.

The production in 1915 is reported as 39,303,279 pounds as against 28,948,211 pounds in 1914, an increase of 10,355,068 pounds, or 35.7 per cent. Further details respecting production will be found in the remarks on nickel.

British Columbia also shows a largely increased production in 1915, the total being 56,692,988 pounds, as against 41,219 pounds in 1914, an increase of 15,473,786 pounds, or 37.5 per cent. The 1915 production in this province included 47,064,234 pounds recovered in blister and matte, etc., and 9,628,754 recovered from ores shipped to smelters outside of Canada. The coast mines including the Britannia, Texada Island and Anyox mines, etc., are credited with 33,980,508 pounds

The total value of the imports of copper in 1915 are recorded as \$3,467,586 as against \$4,256,901 in 1914. The imports in 1915 included 16,818,116 pounds of copper in pigs, ingots and manufactures, valued at \$3,104,382; other manufactures valued at \$263,922. and copper sulphate 1,854,850 pounds, valued at \$99,282.

The imports in 1914 included 26,280,815 pounds crude and manufactured copper valued at 3,983,322; copper sulphate 1,143,039 pounds valued at \$53,802 and other manufactures of copper valued at \$219,777.

Nickel.

Refined metallic nickel is now being recovered in Canadian refineries but only in small quantities and as a by-product in the smelting and refining of the silver-cobalt-nickel ores of the Cobalt district, nickel oxide having been recovered in these smelters for several years. The nickel-copper ores of the Sudbury district supplemented by a small tonnage of similar ores from the Alexo mine in Timiskaming, north of Cobalt are the main sources of nickel production which in 1915 increased nearly 50 per cent. as compared with 1914 and is greater than the production in 1913, the largest previous record, by over 37 per cent.

	1911. Tons *	1912. Tons.*	1913. Tons.*	1914. Tons.*	1915. Tons.*
Production of Nickel in Canada.					
Ore mined	612,511	737,584	784,697	1,000,364	1,364,048
Ore smelted	610,834	725,065	823,403	947,053	1,272,283
Bessemer matte produced.	32,607	41,925	47,150	46,396	67,703
Copper content of matte.	8,966	11,116	12,938	14,448	19,608
Nickel content of matte.	17,049	22,421	24,838	22,759	34,039
Spot value of matte	\$4,945,592	\$6,303,102	\$7,076,945	\$7,189,031	\$10,352,344
	1911. Lbs.	1912. Lbs.	1913. Lbs.	1914. Lbs.	1915. Lbs.
Exports of Nickel from Canada.					
Nickel contained in matte, etc.—					
Exported to Great Britain	5,023,393	5,072,867	5,164,512	10,291,979	13,748,000
do to United States	27,596,578	39,148,993	44,224,119	36,015,642	52,662,400
do to other countries . . . . .	.....	.....	70,386	220,706	.....
	32,619,971	44,221,860	49,459,017	46,538,327	66,410,400
	1911.	1912.	1913	1914	1915.†
Imports of Nickel into U. S.					
Gross tons or ore and matte	23,993	33,101	37,623	29,564	41,053
Nickel contents, lb.	29,545,967	42,168,769	47,194,101	35,006,700	50,099,707
Exports of Nickel from U. S.					
To France, lb.	5,463,358	5,083,947	3,631,858	3,457,157	2,749,554
To Netherlands, lb.	9,101,150	7,387,447	6,622,811	855,168	52,770
To United Kingdom, lb.	7,196,259	8,191,364	8,221,640	10,836,369	13,570,574
To other countries, lb.	3,338,819	5,152,258	10,096,779	12,446,458	8,130,687
Total, lb.	25,099,586	25,815,016	29,173,088	27,595,152	24,503,585

*In tons of 2,000 lb. †Eleven months only.

and the Trail Creek and Boundary mines with 22,712,480 pounds.

The Yukon production is reported as 534,216 pounds as against 1,367,050 pounds in 1914.

The New York price of electrolytic copper rose from a minimum of 13 cents per pound in January to 20 cents in June, falling again to 16 cents in August, then rising steadily to the end of the year, reaching a maximum of 22 cents at the end of December. The average monthly price for the year was 17.275 cents, as compared with an average of 13.602 cents in 1914, an increase of 3.673 cents, or 27 per cent. This is the highest average monthly price since 1907, when 20.004 cents per pound was reached.

Exports of copper according to Customs records were: Copper fine in ore, etc., and copper in pigs, 102,729,579 pounds valued at \$12,460,356, there were also exports of old and scrap copper amounting to 4,161,600 pounds valued at \$616,553.

The nickel-copper ore, derived from 12 separate mines, is reduced in smelters and converters to a Bessemer matte containing from 77 to 82 per cent. of the combined metals and shipped in that form to Great Britain and the United States for refining, the product of the Canadian Copper Company going to New Jersey and that of the Mond Nickel Company to Wales. A portion of the matte produced by the Canadian Copper Company is used without the intermediate refining of either metal for the direct production of Monel metal, an alloy of nickel and copper.

The total production of matte in 1915 was 67,703 tons, containing 39,216,165 pounds of copper and 68,077,823 pounds of nickel and valued by the producers at 10,352,344. The tonnage of ore smelted (part being previously roasted) was 1,272,283. The production in 1914 was 46,396 tons of matte containing 28,895,825 pounds of copper and 45,517,937 pounds of nickel and valued at \$7,189,031.

The reported recovery of nickel from the ores of the Cobalt district was 55,325 pounds of metals and 200,032 pounds of nickel oxide. The recovery in 1914 was 392,512 pounds of nickel oxide.

The exports of nickel are reported by the Customs Department as 66,410,400 pounds valued at 7,394,446 or an average of 11.13 cents per pound. Since about 80 per cent. of the Canadian nickel production is exported to the United States, it may be of interest to add to the Canadian statistics a record of the imports (eleven months only in 1915) of nickel into and the exports from the United States.

The exports of nickel from the United States during the eleven months ending November were 24,503,585 pounds valued at 9,299,234, or an average of 37.95 cents per pound. More than 50 per cent. of these exports went to the United Kingdom. The value of the United States exports in 1914 ranged from 31 to 39 cents per pound and averaged about 34 cents.

It will be noted that a larger quantity of nickel finds its way to the United Kingdom through United States refineries than is exported directly from Canada.

The price of refined nickel in New York remained fairly constant during the first seven months of the year, quotations published by the Engineering and Mining Journal being 40 to 45 cents per pound for ordinary forms with 5 cents per pound more asked for electrolytic nickel. During the last five months of the year prices ranged between 45 and 50 cents for ordinary forms.

Lead.

Although there was an increase of nearly 25 per cent. in the production of lead the 1915 output has been exceeded in six of the past 15 years. The production of lead in 1914 was 45,377,065 pounds, which, valued at 5.60 cents per pound, the average price of pig lead in Montreal for the year, would be worth \$2,541,116. The production in 1914 was 36,337,765 pounds, valued at \$1,627,568, or an average of 4.479 cents per pound. The 1915 production consists chiefly of pig and manufactured lead produced at Trail, B.C., but includes also an estimate of the lead probably recoverable from ores shipped to smelters outside of Canada. The entire output of the Surprise mine in the Slocan District, B.C., was shipped to the United States, refined in bond, and sold in London.

The exports of lead in ore, etc., in 1915 are recorded by the Customs Department as 1,845,100 pounds, valued at \$40,273, and of pig lead 2,066,929 pounds, valued at \$79,067. Exports in 1914 were 246,100 pounds of lead in ore and 510,573 pounds of pig lead.

The total value of the imports of lead and lead products in 1915 was \$2,479,261 as against \$1,042,538 in 1914. The 1915 imports included 42,616,200 pounds valued at \$2,010,006, manufactured lead 3,102,838 pounds valued at \$184,581, other manufactures valued at \$102,439, litharge 1,579,800 pounds valued at \$89,232 and lead pigments 1,709,035 pounds valued at \$93,003. The imports of litharge and pigments would contain approximately 1,565 tons of metallic lead and the total import of lead would therefore exceed 24,425 tons as shown by this record. The imports in 1914 were equivalent to about 10,869 tons.

The average monthly price of lead in Montreal varied between a minimum of 4.27 cents in January and a maximum of 6.61 cents in December, averaging for the year 5.60 cents. This is the producer's price for lead in car lots as per quotations kindly furnished by Messrs. Thos. Robertson & Co.

The average monthly price of lead in New York was 4.628 cents and in London £22.917 per gross ton, equivalent to 4.979 cents per pound.

Zinc.

Complete returns of zinc shipments have not yet been received but the tonnage is estimated at 15,553 tons containing 12,400,000 pounds of zinc. Shipments include several hundred tons from Notre Dame des Anges, Quebec, but the greater part is from some fifteen properties in British Columbia. Zinc shipments in 1914 were reported as 10,893 tons containing 9,101,460 pounds of zinc.

The Consolidated Mining & Smelting Co. at Trail, B.C., after successful experimental development has installed at Trail a zinc recovery plant, having an initial daily capacity of 35 tons of refined zinc, and has entered into a contract with the Shell Committee for a considerable tonnage of zinc to be delivered during 1916. A small quantity of zinc was recovered during 1915 in connection with the experimental work.

The Electric Zinc Co. has constructed a plant at Welland, Ontario, for the recovery of refined zinc from zinc oxide. It is intended, eventually, to treat the zinc ores from Notre Dame des Anges, Quebec, at this plant.

At Silverton, B.C., a demonstration plant, using the French process for the recovery of zinc, was operated during 1915 and satisfactory results are claimed.

In August the Dominion Government made an announcement with respect to a proposed bounty on zinc as follows:

"Bounties on a sliding scale not exceeding two cents per pound will be granted upon production in Canada from Canadian ores of zinc containing not more than 2 per cent. impurities, when the standard price of zinc in London, England, falls below £33 per ton of 2,000 pounds, provided that bounties shall not be payable on zinc produced before the expiration of the war or after the 31st day of July, 1917, or on zinc contracted for by the Shell Committee at a price of 8 cents or over per pound. Total amount of bounty to be paid not to exceed \$400,000."

The price of spelter in New York varied between a minimum of 5¾ cents per pound in January and a maximum of 25 to 27 cents in June, the price at the close of the year being from 15¾ to 16¾ cents and the average for the year 13.230 cents per pound.

The price of high grade spelter rose from 10 cents at the beginning of the year to over 40 cents in midsummer and was maintained fairly strongly through the balance of the year at from 35 to 40 cents.

Other Metals.

Antimony.—After several years of no production the demand and high prices in 1915 caused a renewal of activity in mining antimony ores at West Gore, Nova Scotia, and Lake George, New Brunswick. About 1,288 tons of concentrates were shipped to England from the former locality. The antimony smelter at Lake George was operated toward the end of the year with a small production of refined antimony, and there was also some recovery of refined antimony at the lead refinery at Trail, B.C. Antimony ores are also reported to have been shipped from Carpenter Creek, Slocan, from Bridge River District, Lillooet, B.C., and from the Yukon, but no record has been obtained. The total production reported is estimated at about 961,040 pounds of antimony refined and in concentrates.

The recorded exports of antimony ore in 1915 were 1,149 tons valued at \$8,990, while the imports included

ed antimony or regulus of, etc., 1,962,194 pounds valued at \$344,918, and antimony salts 67,956 pounds valued at \$10,320.

The price of antimony, ordinary grades, in New York, ranged between a minimum of 13 cents in January to a maximum of 42 cents in December, averaging about 30 cents for the year. The price of "Cook-sons" in December was 55 cents per pound and the year's average 40 cents.

Cobalt.—Metallic cobalt is now being recovered as well as cobalt oxide, at the smelters at Deloro and Thorold. The silver-cobalt-nickel ores of the Cobalt district are reduced in these smelters, silver being the principal product with arsenous oxide, metallic cobalt and nickel, cobalt oxide and nickel oxide as by-products. Returns received show a production in 1915 of 211,610 pounds of metallic cobalt and 379,219 pounds of cobalt oxide, equivalent to a total of 477,063 pounds of metal. In 1914 the production was reported as 899,027 pounds of cobalt oxide and 242,572 pounds of cobalt contained in residues sold outside of Canada or equivalent to a total of 871,891 pounds of cobalt. The price of cobalt is seldom quoted in the Mining Journals. However, a price of \$2.00 per pound 97 per cent. cobalt metal was recorded by the Engineering and Mining Journal in September and November.

Molybdenum.—A production has been reported of about 28,600 pounds of molybdenite valued at \$28,460, including cobbled molybdenite and molybdenite contained in ore shipped to concentration plants. There were also about 50 tons of low grade ore sent to the Mines Branch Ore Testing laboratories for experimental concentration. The export of molybdenite was prohibited to other than British destinations except under license, and from September 23rd the British Government requisitioned all molybdenite arriving in the United Kingdom at a price of 105 shillings per unit of MoS_2 . C.I.F. Liverpool, and appointed Messrs. H. A. Watson & Co., Liverpool, as buyers.

Platinum.—Efforts are being continued to recover platinum from the gravels on the Tulameen river in the Similkameen district of British Columbia, and there is also occasional recovery of small quantities from the gold gravels of Quesnel division, Cariboo district. A recovery of about 20 ounces is reported in 1915. There was no recovery of platinum from the Sudbury nickel-copper mattes.

Customs records show an export of platinum of 236 ounces valued at \$11,052, but this may possibly include old metal.

The price of refined platinum in New York, which was about \$41 per ounce in January, fell to \$38 in June and July, but increased to an average of \$85.50 in December. The year's average was about \$47.

Iron Ore.

Iron ore shipments in 1915 amounted to 398,112 short tons, valued at \$774,427 as compared with 1914 shipments of 244,854 short tons, valued at \$542,041. The 1915 shipments included hematite 205,989 tons, roasted siderite 132,906 tons, and cobbled magnetite and concentrates 59,217 tons. The 1914 shipments included hematite 89,454 tons, roasted siderite 109,838 tons, and cobbled magnetite and concentrates 45,562 tons.

In the Great Lakes area the same ore prices prevailed as in 1914 and 1910, which were the lowest recorded in many years.

Mine operators report 93,444 tons of ore exported to the United States and 304,668 tons shipped to Canadian furnaces.

According to the records of the Customs Department

exports of iron ore amounted to 79,770 tons, valued at \$206,823, and imports of iron ore to 1,499,722 tons, valued at \$2,320,066.

Shipments of iron ore from Wabana Mines, Newfoundland, in 1915, by the two Canadian companies operating there were 868,451 short tons, of which 802,128 tons were shipped to Cape Breton and 66,323 tons to England. In 1914 the shipments were 639,430 short tons, of which 422,920 tons went to Cape Breton and 216,510 to the United States and Europe.

Pig Iron.

The total production of pig iron in Canadian blast furnaces in 1915 was 913,719 short tons, valued at approximately \$11,592,819, as compared with a production of 783,164 short tons in 1914 valued at approximately \$10,002,856. A large proportion of this production is used directly in the manufacture of steel and the values are in part estimated. The 1915 output shows an increase of 130,555 tons or 16.67 per cent. over that of 1914 and compares favorably with the average of recent years.

Of the total production in 1915, 13,692 tons were made with charcoal and 900,027 tons with coke.

Included in the ore charged to blast furnaces there was 293,305 short tons from Canadian mines and 1,463,681 tons of imported ore. Of the imported ore approximately 840,587 tons come from Newfoundland.

The blast furnace plants, operated for varying periods of time, included those of the Dominion Iron and Steel Co. at Sydney, N.S., the Nova Scotia Steel and Coal Co. at North Sydney, N.S., the Standard Iron Co. at Deseronto, Ont., the Steel Company of Canada at Hamilton, Ont., the Canadian Furnace Co. at Port Colborne, Ont., and the Algoma Steel Co. at Sault Ste. Marie, Ont.

There was also in 1915 a production in electric furnaces of 10,794 tons of ferro-alloys (chiefly ferro-silicon with a very small tonnage of ferro-phosphorus), valued at \$753,406, as compared with a production in 1914 of 7,524 tons, valued at \$478,355. About two-thirds of the ferro-silicon production in 1915 was of 50 per cent. grade, and the balance was of 75 and 85 per cent. grade.

The exports during 1915 of pig iron were 17,307 short tons, valued at \$231,551, or an average per ton of \$13.38, and of ferro-silicon and ferro-compounds 9,238 tons valued at \$537,081, an average of \$50.81 per ton, or a total of 26,545 tons valued at \$768,632 as compared with a total in 1914 of 19,063 tons valued at \$486,366. The imports were 47,482 tons of pig iron valued at \$624,200, or an average of \$13.15 per ton, and 13,758 tons of speigeleisen, ferro-manganese and ferro-silicon valued at \$807,312, or a total of 61,240 tons valued at \$1,431,512.

Electro Metals, Ltd., producing ferro-silicon, have considerably enlarged the capacity of their plant at Welland, Ontario, to meet the increased demand for their product occasioned by the war. In addition to sales for Canadian consumption a large and important tonnage has been furnished to Great Britain, Russia and the United States.

Steel Ingots and Castings.

The production of steel ingots and castings in 1915 including 5,626 tons from electric furnaces, was 1,020,335 short tons, as compared with a production in 1914 of 828,641 tons. The 1914 production included open-hearth ingots 608,383 tons; bessemer ingots 203,184 tons; direct open-hearth castings 15,315 tons; and other steel castings 1,759 tons, these figures being a revision of those previously published.

(To be continued.)

D. H. McDougall

The appointment of Mr. D. H. McDougall to be the general manager of the Dominion Steel Corporation has met with very general approval, and has caused much gratification to Nova Scotians, and to residents of Cape Breton in particular. The Halifax Chronicle writes editorially:—

The following account of Mr. McDougall's career given by the "Sydney Record" is fairly accurate, and is therefore quoted in full:

"Mr. D. H. McDougall, the newly-appointed general manager of the Dominion Steel Corporation, has, in various capacities, been associated with the fortunes of the Dominion Coal Company and the Dominion Iron and Steel Company since the very beginnings of the vast enterprise of which he is now the operating head. Mr. McDougall was born in Glace Bay, and saw the first stages of the Coal Company's growth, when in 1893, the various independent coal companies were amalgamated to form the Dominion Coal Company; and in the course of his association with Glace Bay, has seen coal mining develop from the primitive horse-gin at the Sterling mine, to the magnificent hoisting arrangements of the present day.

"Beginning as a boy and working up through various stages of experience and promotion, the new general manager entered the survey staff of the Coal Company, afterwards joining the engineering staff of the Steel Company. He spent several years in the employ of the New York Central as an assistant engineer, coming back to the Steel Company to become field engineer. Mr. McDougall was then appointed as superintendent of mines and quarries in charge of the Steel Company's ore and limestone mines, and the general provision of raw materials. In the beginning of 1910 Mr. McDougall was appointed as assistant general manager of the Dominion Coal Company, Mr. M. J. Butler being at that time general manager of the Dominion Steel Corporation. On Mr. Butler's retirement from this position, Mr. McDougall was appointed general manager of the Coal Company, having throughout also retained his position as superintendent of mines and quarries of the Steel Company.

"Mr. McDougall's position now involves direction of the coal mines at Glace Bay, and at Springhill, of the Steel Company's operations in Sydney, of the ore mines at Wabana, the limestone quarries at Marble Mountain and Georges River, C.B., at Port-au-Port, Newfoundland; of extensive lumbering operations and saw mills around Springhill and in New Brunswick; of two railways, namely the Sydney & Louisburg Railway and the Cumberland Railroad. In addition the corporation controls and operates extensive loading and discharging plants at Sydney, Louisburg, Parrsboro', Halifax, St. John, Quebec and Montreal. The workmen of the Steel Corporation number approximately 16,000 persons, and the operations of this great enterprise cover the whole of Eastern Canada and Newfoundland.

"Mr. McDougall has achieved his present position by dint of unremitting labor, by tactfulness and courtesy under the most trying circumstances, and by a very characteristic modesty. It is a source of peculiar gratification to Cape Breton people that the direction of what is probably the largest single industrial enterprise in Canada, excepting the Canadian Pacific Railway, should have been placed in the hands of a local man, still young in years, deservedly popular with his subordinates, and with a past record that warrants expectations of a successful future both for Mr. McDougall and the enterprise that he now directs in its entirety."

Mr. McDougall is president of the Mining Society of Nova Scotia, a vice-president of the Canadian Mining Institute, a member of the Institution of Mining Engineers (England), and a member of the Canadian Society of Civil Engineers.

PERSONAL AND GENERAL

Hon. Lorne A. Campbell, Minister of Mines for British Columbia, who was re-elected by a by-election held on February 26 to represent Rossland constituency in the Provincial Legislature, paid a visit to Ottawa early in March on official business.

Mr. James Cronin has returned to his mining property in the Babine region, Omineca mining division, after a short visit to his home in Spokane, Washington. Mr. Cronin has long been known in British Columbia as a successful mine manager, for it was he who directed the development of the St. Eugene mine, in East Kootenay, from the time it was staked until it became the biggest lead mine in Canada.

Mr. Oscar Laehmud, of Greenwood, Boundary district, B.C., went to New York City at the end of February to attend the annual meeting of the British Columbia Copper Co., of which he is general manager.

Mr. Oscar V. White, manager of the Slocan Star silver-lead-zinc mine and concentrating plant in Slocan district, British Columbia, has been on a visit to the Coeur d'Alene district of Idaho, where he investigated milling practice at several of the local silver-lead-zinc mines in successful operation there.

Mr. D. J. Williams, who was manager for the Montana Consolidated Development Syndicate during the three-year period it was operating under lease the Rocher Debole copper mine, in Omineca mining division, British Columbia, is remaining in charge of the mine now that the Rocher Debole Copper Company has resumed possession and is operating it.

The management of the Standard Silver-Lead Mining Company, with mine and concentrating plant near Silverton, Slocan Lake, British Columbia, last month declared the usual monthly dividend of \$50,000, payable in March.

Mr. S. A. Wookey of the Hollinger staff has been appointed manager of the Schumacher mine, succeeding Mr. Jos. Houston, who is now assistant manager at the Dome mine.

Mr. E. Flynn has been appointed instructor in mining at the Haileybury High School.

Mr. H. J. Stuart has examined the McCrea claims in Pacaud township, Timiskaming district, for the Crown Reserve Mining Co.

Mr. H. P. DePencier, third vice-president of Dome Mines, Ltd., has been at the Dome mine recently, in the absence of General Manager Kaeding.

Mr. C. D. Kaeding has returned to Porcupine.

Mr. Chas. J. Murphy, who for some years has been chief engineer of the Crow's Nest Pass Coal Co., has returned from the West and opened an office in St. Catharines for consulting work. Mr. Murphy is a graduate of the University of Toronto. He was for some time on the staff of the Canadian Copper Co. at Copper Cliff.

Dr. Henry K. Benson, professor of industrial chemistry at the University of Washington, in Seattle, has been appointed director of the newly established Bureau of Industrial Research, the first such institution on the Pacific Coast.

Mr. J. H. Stovel, recently manager of the Bruce Mines for the Mond Nickel Co., has been appointed a provincial mine inspector for the Sudbury district.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND ELK LAKE

As the weather grows milder a tendency to take up old silver prospects becomes more pronounced. So much snow has fallen in the bush this year that it is discouraging to attempt to do work until some of it has disappeared, but the eagerness with which development work will be taken up directly it is possible to see the ground, cannot be doubted.

Ophir.—In South East Coleman the Ophir has stopped diamond drilling as there is now a proposal to merge this company with the John Black claims. These claims lie together, and the whole block would make 60 acres. Four or five years ago shafts were sunk below 300 feet on both the Ophir and the John Black. A little ore was found but not sufficient to make mining profitable. The Ophir owns 20 acres and the John Black 40. The John Black shaft is only 140 feet from the Ophir line, so that any merger would make the general development of these properties very economical.

The Peterson Lake Mining Company is sinking a small shaft on the Reliance claim in Coleman Township. This claim was staked at the same time as the Hargraves and is better known as the White Silver Mining Company property. Although it lies in the centre of the Cobalt camp, little or no work has ever been done on it before. There is a small vein in an open cut on the surface and a very little high grade ore was found.

The Right of Way Mining Company has shipped another car of ore. It is estimated to have contained 48 tons, and the concentrates will run little less than 1,000 oz. to the ton. The ore was shipped from the shaft at the south end of Cobalt Lake to the Northern Customs concentrator and treated there. Work is now in progress not only at the other end of the lake but also in the old workings of the mine.

Nipissing.—More than double the amount of bullion was shipped in February by the Nipissing as compared with January. Production was only slightly higher. It is always to be remembered that production is of Nipissing ore only, while bullion shipments consist not only of Nipissing ore but all customs ore purchased by the Nipissing Mining Company and refined in the high grade mill. The figures for the first two months of the year are as follows:

	Net Production.	Bullion shipped.
January	169,802 oz.	148,730 oz.

The high grade mill treated 124 tons and shipped 535,514 oz. The low grade mill treated 6,953 tons.

The results of development at the third level of the Meyer on vein 490 are still negative. Going back to the old workings of vein 64, a branch vein on the third level is producing much more ore than was anticipated. The vein is two inches wide and assays 2,200 oz. Most of the ore produced during the month came from stopes at shaft 80 and from development.

Glen Lake.—Very interesting developments are awaited in the drift on the Glen Lake Cobalt Mines. This company has a lease on the old Foster. An ore shoot has recently been struck at the 50-foot level and it is expected that the vein cut is an extension of one of the Lawson veins. The ore shoot is only 15 feet

long, but it is two inches wide and very rich. The vein is all in the conglomerate and is being drifted upon in the hope of picking up other ore shoots. From the old Foster shaft a long crosscut has been pushed under Glen Lake to within 40 or 50 feet of the Bailey line. Another crosscut will soon be started running parallel to the Bailey line with the hope of picking up extensions of the Bailey veins.

Shipments.—There is a much more marked disposition to ship ore than in the preceding month. Both in bullion and concentrates this is the case, so that the month of March should show a production much higher than the first two months of the year.

In Gowganda, despite the very poor transportation facilities, there is quite a lot of activity in old prospects. At Calcite Lake, five or six miles east of Gowganda, two companies are working again with small forces. At Wigwam Lake the Barbara Mines is operating with a small plant. On the Gowganda ridge the Reeves-Dobie is stopping out some rich ore. On the Elk Lake Branch of the T. & N. O. Railway a Montreal syndicate has applied for a charter to operate claims in the Kenabeek district. This company is to be known as the Royal Mining Company. A small gang of men are at work.

PORCUPINE, KIRKLAND LAKE AND BOSTON CREEK

Dome.—In the new central shaft at the Dome, mill ore has been struck and the rock being broken in the further development of this shaft is going to the mill. The location of this shaft was expressly chosen so that it should not be in ore. There was no ore in it until below the 600-ft. level, when the difference of the character of rock was noticed and assays were taken. It was then found that the rock contained good values and should not be thrown on the waste pile. The ball mill in the Dome mill is still proving most satisfactory. When the other two eight-ft. mills arrive they will at once be installed and it is probable that some of the original 40 stamps will be taken out to make room for them. The production from the Dome during February amounted to \$169,500. This may have been due to that fact that during the cold weather the broken ore in the big ore chutes froze up and difficulty was experienced in breaking them away. The remodeled Dome mill with a maximum capacity of 45,000 tons a month should be completed by the end of May. Two tube mills are now on the ground.

Deloro.—The three claims belonging to the Ankerite Gold Mining Company in Deloro have been optioned to Mr. Clifford E. Smith of Toronto. The claims are better known as the Dobie-Armstrong claims and are controlled by a syndicate in which Sam Dobie, Frank Armstrong and others are prominent. In 1911-12 some work was undertaken on these claims and some spectacular ore was mined from a drift on the 50-ft. level. These claims lie between the old Standard Mine, which is now being worked by the Porcupine Premier and the Maidens-MacDonald, which the La Rose have under option.

Vipond.—The new ore body at the Vipond is still looking very promising and it has been drifted upon for upwards of 100 ft. and maintains both width and grade. It has also been picked up at the 500-ft. level.

Lucky Cross.—The Trethewey Mining Company has started to work dewatering the Lucky Cross Mine at Swastika. The old plant was complete and in good ore and pumping has already commenced. When the workings are dry the old drifts at both levels will be carefully sampled. There is a mill on the property, but it will have to be remodeled before a satisfactory extraction can be obtained.

At Boston Creek the Crown Reserve has met with some success in the development of the McCrea claims. In a test pit down 10 ft. a shot in the vein on the hanging wall opened up some very pretty ore showing plenty of free gold. The claims upon which the find was made are in Picaud Township within a few feet of the Boston Township line.

In the same township the plant at the Miller Independence Mines is now running and very much more rapid progress will now be made by this company, in their development work.

In Munro Township the Croesus Gold Mines has cut its vein at the 300-ft. level and commenced to drift. The vein was also cut at the 250-ft. level, and there is now considerable work done at the 200-ft. level. The only other property upon which much work is being done in Munro Township is the Munro Consolidated.

Hollinger.—For the first period of the new year, Hollinger profits showed a falling off of \$45,083. This is partly accounted for by the fact that in the 13th period of 1915, certain additions were made for accounting purposes which should have been distributed over the whole of the year. Tonnage is gradually being raised to the desired 2,000 tons a day. The grade of the ore mined was \$1.07 less. Milling costs were exactly the same, but mining costs were cut down by 82 cents a ton. Gross profits were \$174,996. Tonnage treated, 30,817; grade, \$9.30; total costs, \$3,129; surplus, \$1,533,206. The most significant feature of the report was the fact that about three-quarters of the ore came from development and only one-quarter from the stopes. Expenditure for plant amounted to 14,526, of which \$13,278 was for the mill extension.

The new central shaft at the Hollinger is now broken through to below the 800-ft. level. To the 425-ft. level it has been broken to the full dimensions of the six compartments and concreted. It is the first shaft in Ontario that has been treated in so permanent a manner. It is believed that the small amount of repairs necessary will more than offset the initial expenditure, in comparison with ordinary timbering. The long cross-cut to the Vipond boundary has now been pushed forward 300 ft. There is a distance of 2,300 ft. yet to traverse before the shaft which is being sunk on the Vipond is reached.

The Hollinger staff is now in its new office. The main office is to be on the ground floor and the engineering office on the second. There will be accommodation for members of the staff on the upper floor.

BRITISH COLUMBIA

Weather conditions improved during the latter half of February, so that the transportation of ore was again practicable in mountainous parts of mining districts where there had been a temporary suspension of ore shipping consequent on the heavy snowfall of two or three previous weeks.

For four consecutive weeks the **Standard** silver-lead mine, near Silverton, was not among those from which ore was received at the Trail smelting works. While the reason for this has not been made public, it is prob-

able that the sinking at the Standard shipping dock on Slocan lake during stormy weather early in February of a scow laden with ore and concentrate has been the cause, for there is available in the mine an ample supply of ore to admit of shipments being regularly maintained whenever shipping facilities are in working order.

Deep snow at Rossland seems to have made a difference in the output in both January and February. The total quantity of ore shipped during the first eight weeks of 1916 having been nearly 10,000 tons less than in the corresponding period of 1915, but there, too, there is plenty of ore opened in the larger mines, so that a bigger output will be made whenever required for the smeltery.

Ore Receipts at Trail.

The quantity of ore received at the smelting works of the Consolidated Mining and Smelting Co., Trail, during four weeks ended February 24, was 33,436 tons, as compared with 32,075 tons for the corresponding period to January 27, inclusive. Of the February total, 28,604 tons was from the company's own mines and 4,832 tons was of custom ores. The company's mines and their production were as follows: In East Kootenay, Sullivan, 4,680 tons; Ainsworth, No. 1, 1,244 tons; Rossland, Centre Star group, 13,139 tons, and Le Roi, 9,541 tons, together 22,680 tons. With the exception of the Centre Star, the output of which was 934 tons less than in January, all the company's mines above mentioned made a larger output in February. It is again noticeable, as in January, that more than two-thirds of the ore received at Trail during February was from Rossland mines. Details of total receipts for the last four week period are as under:

East Kootenay—	Tons.	Tons.
Lead Queen	30	
Monarch	17	
Sullivan	4,680	
	—————	4,727
Ainsworth—		
Bluebell	616	
Cork-Province	6	
Florence	77	
Martin	30	
No. 1	1,244	
	—————	1,973
Slocan—		
Enterprise	29	
Galena Farm	40	
Noonday	32	
Rambler-Cariboo	166	
Reco.	39	
Ruth	101	
Slocan Star	186	
Yakima	22	
	—————	615
Nelson—		
Emerald		104
Rossland—		
Centre Star Group	13,139	
Le Roi	9,541	
Le Roi No. 2, Ltd. (Josie)	1,130	
Velvet	33	
	—————	23,843
Revelstoke—		
Lanark		32
Kamloops—		
Iron Mask		142
Lake Louise (Alberta)—		
Yellow Jacket		52

State of Washington, U.S.A.—

Bonanza, Bossburgh	206
United Copper, Chewelah	929
Ben Hur, Republic	440
Knob Hill, Republic	211
Tom Thumb, Republic	162
	1,948

Total for four weeks in Feb 33,436

For the corresponding period of 1915, the total was 35,938 tons, in the following proportions: East Kootenay, 3,231 tons; Ainsworth, 43 tons; Slocan, 261 tons; Nelson, 512 tons; Rossland, 29,948 tons; Boundary, 46 tons; State of Washington, 1,897 tons.

Yale District

The following notes relative to mining in Nicola, Vernon, Kamloops, Ashcroft, and Yale mining divisions, all within the boundaries of the extensive Yale district, have been taken from the Provincial Mineralogist's "Preliminary Review" of mining in the Province in 1915, issued early in February:

Nicola.—The only production from metalliferous mines in Nicola division consisted of two sample shipments from the Copper King group, on Ten-mile or Guichon creek, and a shipment of high-grade ore from the **Copper Star** mineral claim, situated at the extreme north end of the Aspen Grove camp. Aside from the work at these two localities, there has been but very little activity in metalliferous mining in the Nicola division.

No work was done on the gypsum deposits near Merritt.

The coal mining industry in the Nicola-Coldwater coal fields was not as prosperous as during 1914. The reasons for this are attributed by the colliery managers chiefly to the substitution of fuel oil on locomotives, as the bulk of the demand for the coal in this field was, in the past, for firing locomotives. The depressed conditions have been taken advantage of by the managements of the Middlesboro' Collieries and the Inland Coal and Coke Company to open new mines in virgin ground, in order to be in readiness to supply coal for any market offering.

Vernon.—Placer gold valued at about \$3,000 was recovered on Siwash creek previous to July last, when operations ceased because of a lack of sufficient water to pipe with. These operations were conducted by the Union Hydraulic Mining Company, with headquarters in Spokane, Washington.

At the **Monashee** mine, about 50 miles east of Vernon, development work was being actively carried on until about July last, when work was suspended and the manager left for his headquarters in Minneapolis.

At the **St. Paul** mine work was carried on for a portion of the season; the ore mined, about 150 tons, was treated in a 2-stamp mill on the property.

Kamloops.—The **Iron Mask** was the only mine producing in the Kamloops district during 1915. Development work on quite an extensive scale was done on the 750-ft. level of this mine, and a long tunnel started on that level towards the Erin mine, about 1,500 ft. distant, which it is proposed to connect with the Iron Mask, and open a new shaft between the two properties, by raising from the tunnel level to the surface. This shaft will, when completed, become the main outlet for ore from both mines. Almost 2,000 tons of ore and concentrates were shipped.

Ashcroft.—In the Highland Valley portion of the Ashcroft mining division there has been greater ac-

tivity than in any other section. Several properties have been bonded by outside syndicates, and shipments of about 100 tons of high-grade copper ore have been made from the Storm group by Stuart Henderson, of Victoria, also about 50 tons from the Glossie group by Carlson, Vosburg, Gerle, and Dunlevy, who had bonded the property from J. W. Burr, the original owner, but failed to meet the payments.

Yale.—In the Yale mining division the most noteworthy occurrence during 1915 was the discovery of high-grade copper ore outcroppings near Jones Lake, in the range of mountains between the Fraser river and Chilliwack lake. The claims staked are said to be about 18 miles distant from Hope in an air line.

Because of the extreme low water in the Fraser river, several placer miners have been taking advantage of the opportunity to clean up ground near the middle of the river which, during normal seasons, is unapproachable because of the depth of water and the rapidity of the current.

Lillooet District.

The Provincial Mineralogist's brief summary of Lillooet district follows:—

During the season of 1915 the Lillooet district obtained its first railway connection with the seaboard, when the Pacific Great Eastern Railway, in the early part of the season, completed its tracks to the town of Lillooet and later continued its service as far as Clinton.

Formerly, the lack of transportation facilities deterred even the development of the mineral prospects which had been located adjacent to the railway, and the mineral output of the district was restricted to a limited amount of gold, either placer or produced by small stamp mills crushing quartz.

The advent of the railway will, it is expected, stimulate the prospecting for and development of lode mines in this district, in which, for geological reasons, there is a probability that they exist.

It is as yet too soon to expect any great results from this cause, and at present the only part of the district in which any serious attempt at lode mining is being made is on Cadwallader creek, where, in 1914, the **Coronation** milled some 120 tons of quartz, carrying about \$40 to the ton in gold.

While this property did not make any output in 1915, a small force of men has been at work developing, with, it is reported, satisfactory results.

Development was also carried on at the **Pioneer** by Fergusson et al., where considerably increased orebodies have been proven, equally high in grade to those formerly known. A stamp-mill and cyanide plant are now being erected, and a force of men is at work in the mine under the superintendence of Charles Copp.

The **Wayside** has been under development all the season by Paxton and associates. A lot of some 20 tons of ore was treated in a test stamp mill and yielded about \$16.50 to the ton.

The comparatively large amount of development work done in the past few years has not shown the camp to be of greater extent than given in the 1910 report of this department, but it has shown up a number of veins heretofore unknown and has proved some known veins to extend farther than expected.

The placer-gold output of the district is expected to be somewhat higher than for some years back, chiefly due to the exceptionally low water exposing bars in the rivers, thus permitting individual placer-miners and Indians to work them.

GENERAL NOTES.

Shipment of ore from the Yankee Girl mine, in Ymir camp, Nelson mining division, is to be resumed shortly. An aerial tramway, about one mile in length, has been constructed from the mine to the Ymir railway station, so that hauling the ore by horse wagon, as in past years, will no longer be necessary.

A few men are working on the Red Buck mineral claim, on Kennedy mountain, about ten miles up Similkameen river from Princeton. This property is reported to have been bonded by Mr. F. S. Norcross of Copper Mountain, mine superintendent for the British Columbia Copper Co., and a carload of ore was recently shipped from it to that company's smelter at Greenwood.

The Montana Consolidated Development Co.'s lease of part of the Rocher Deboile copper mine, in Omineca division, Skeena county, having expired, the Rocher Deboile Copper Co. is again operating the mine, from which about 17,000 tons of ore, averaging 8 per cent. copper, was shipped to the Granby Co.'s smelting works at Anyox, Observatory inlet, during 1915.

The Silver Standard mine, near Hazelton, Skeena district, has again been sending ore down to the railway. Early in February there was about 120 tons loaded on railway cars ready for shipment to a smelter.

NOVA SCOTIA

Dominion Coal Outputs.—The production of the Dominion Coal Company's collieries for the first two months of the year compares as follows with 1915:

	1915.	1916.
January	225,970	373,000
February	282,373	362,000
	538,343	735,000
Springhill Collieries—		
January	31,210	34,000
February	29,479	33,000
	60,689	67,000
	599,032	802,000

Increase in 1916, 203,000 tons.

The increase in output as compared with 1915 is quite striking, but in making this comparison it must be borne in mind that the first few months of 1915 were months of the leanest description so far as the coal industry was concerned. The collieries at that time were not working in some cases more than two to three days a week, and the Dominion Coal Company's production was from 150,000 to 175,000 tons per month below the capacity of the collieries.

The outputs for February, although larger than in previous years, were very considerably—say 60,000 tons—below the capacity of the mines, and the production barely filled the actual commitments.

Production during the remainder of the year will not show the same ratio of increase over 1915, in fact the production of coal during 1916 will in all probability fall behind the figures of 1915, because of the large production during the last half of 1915, and the continual shrinkage of the number of miners that is being caused by enlistments.

Much confusion is caused in comparisons of production in Nova Scotia by the different periods used in computation. For example, the fiscal year of the Nova

Scotia Department of Mines ends September 30th, the fiscal year of the Dominion Coal Company ends March 31st, and these varying dates are confused with the calendar year. The fiscal year 1915, in the Mines Report of the Province, happened to include with strange exactness the very worst months of the industrial depression, namely the twelve months October 1st, 1914, to September 30th, 1915. Compared with the year ending September 30th, 1914, therefore, a large reduction in tonnage is shown in the Provincial Mines Report. Conversely, the Mines Report for the year ending Sept. 1916 will show an increase over the fiscal year 1915 because the period will include the months commencing October 1st, 1915, when the demand for coal showed such a sudden increase in strength. The members of the Provincial Parliament amused themselves recently by debating the reasons for the difference in production in the fiscal years 1914 and 1915, and it was evident that the effect of the incidence of the fiscal year and its exact coincidence with the period of trade depression was unappreciated by those who took part in the debate.

NEWFOUNDLAND

The first metal electrically smelted in Newfoundland was produced on Thursday evening last. An initial test of the smelter was made and a high-grade copper was produced. The plant worked splendidly and the "run" was made on material brought from Little Bay Copper Mine.

The capacity of the plant was found to exceed expectations of the expert, Mr. Paul Simpson. The plant will smelt about one thousand pounds of ore per hour. In a few days operations will be formally opened by Governor and Lady Davidson. The plant then will be taken over by the Hydro Electric Smelting Co., Ltd., the capital of which has been locally subscribed. To Mr. W. A. McKay, who organized and promoted the whole scheme, much credit is due. The company owns outright Little Bay Mines, where an abundance of ore exists on the surface, many thousands of tons being left there by the old company, which operated when the price of copper was exceedingly low. At the present time copper is worth £135 a ton in England, a price hitherto unknown.

The object of placing the preliminary furnace in St. John's was to avail of the electric power which the Reid Newfoundland Co. could easily dispose of without any embarrassment, and particularly to demonstrate to parties holding promising copper properties the possibility of their being able to market their ore. The establishment of the plant will no doubt be the means of opening up many small mines in the country as the operating of this smelter will mean a constant and available market. The inauguration of this industry will be of great importance, and will certainly mean much for men of small means holding mining claims. The company has about five hundred tons of ore in stock at the smelter to commence operations, and until navigation opens further supplies will be obtained from Batts Hill Mine, Conception Harbor, Harbor Main District, and will be shipped by rail. For the present the output of copper will be utilized by the Newfoundland Shell Company, whose plant is in the neighborhood of the smelter, and who are now about ready to begin operations.

Already as a result of the success of copper smelting, we learn from a reliable source that two more smelters will be erected in Notre Dame Bay at a very early date.

Newfoundland is fortunate in possessing an abundance of water powers which can be availed of very cheaply, and are sure to be of great economic and commercial value in the expansion and development of the mining industry.

Coal.—The coal famine which was threatening St. John's from early winter was relieved by the arrival of the S. S. Alconda from Sydney last week with a cargo of seven thousand tons. Several other smaller steamers and sailing vessels arrived recently, and the S. S. Florizel of the Red Cross Line has arrived with one cargo of three thousand tons, and is due again from Sydney in a few days with another cargo. Sufficient stock is now in store as will relieve the situation for many months to come. What made matters most serious this winter was the arrival in St. John's in January and February of at least twelve foreign-going steamers all short of coal, as a result of very stormy weather and long passages across the Atlantic. As these ships were engaged in carrying supplies to and from England and her Allies we were bound to give them sufficient supplies of coal to reach their destinations. Fortunately but certainly at great sacrifices every ship got a supply and went her way. There was one exception in the case of the "Ontaneda," flying the Norwegian flag. It appears this ship was blacklisted by the British Admiralty for some misdeed, and as a consequence she lay at anchor in the harbor of St. John's for nearly two months without getting coal. Finally last week matters were adjusted and her bunkers supplied, and she was allowed to sail, her owners no doubt giving assurance to walk the straight road.

What probably will result in the exploitation and development of the mineral resources of Newfoundland on a larger and more substantial basis than anything heretofore attempted is to be expected from the report of Mr. Davies, Government Assayist and Chemist. It is understood that His Excellency Governor Davidson who takes a very great interest in all matters pertaining to the development and well being of the country, has been fortunate in bringing before the Imperial authorities the vast and varied mineral resources of the colony, and the matter has been so favorably received that Mr. Davies has been directed to make a most complete and minute report, hence it is not unreasonable to suppose that henceforth the development of the mineral resources of the colony will receive more encouragement from British capitalists than in the past. For many years Newfoundland made every effort to get Englishmen to invest in the minerals of this country, but to no avail. Apparently England was content to buy her iron, lead, copper and other minerals from Germany, Sweden and other countries and leave her own colonies neglected. It is a fact that the great iron mines of Belle Island, of their kind the greatest in the world, went a-begging through the English money markets for a purchaser some years ago, but there was no one to buy, yet at the same time England was importing thousands of tons of iron ore from nations which to-day are arrayed against her with all the fierceness and ferocity of savagery. When the iron mines on Belle Island were purchased by Canadian and American capital and the ore shipped abroad not a cargo could be sold in England. It is a matter of history that the Krupp works of Germany were amongst the largest purchasers of Belle Island ore previous to the war, and it is well known that they had in their possession most correct information in the way of plans and other data in connection not only with the iron deposits of Belle Island, but all other mines and minerals

in the colony. The very guns of the German navy and those trained on the English soldiers and their Allies at the front are in part the product of the iron mines of Belle Island.

It is pleasing to know that all the machinery for the Newfoundland shell factory is now installed, and next week work in connection with the making of shells will begin in earnest. Apart from the constant employment it will give to many hands, it goes to prove that Newfoundland is not alone content in sending soldiers, sailors, airships and money to help the Mother Country in her day of trouble, but with all local capital she intends also to do her share as best she can to speed up the making of munitions of war. A big order for shells has been obtained from the authorities at Ottawa and, according as the shells are turned out, they will be shipped direct to England.

Work on the iron mines at Belle Island during the past winter has been more vigorously pursued than at any time since the opening of these mines. The largest number of miners ever employed have been working day and night uninterruptedly for months past and immense piles of ore are being stacked near the piers awaiting early shipments. It is thought by the end of March some cargoes will be shipped, at least as early as navigation will permit.

Work at our copper mines has maintained a constant and steady increase all through the winter, and many cargoes will be ready to ship abroad as soon as conditions are favorable. It is thought that as a consequence of the increased price for copper, and the result that will accrue from the electric smelter now in operation a great stimulus will be imparted to copper mining in this country. With the return of spring many copper properties which have remained idle for years will again be worked.

PREMIER LANGMUIR MINES.

In an article that appeared in this Journal of December 1st last, under the heading "Silver at Poreupine," it was stated that Premier Langmuir mines, the owners of the well-known deposit of barite in Langmuir Township, were shipping barite to the United States. We find, however, that no shipments have yet been made. Native silver and argentite were found to be present to such an extent in the barite, that it would be unwise to ship without first separating the silver. It is, we understand, the intention of the company the coming season, to install a concentrator to make the necessary separation, and it would not be surprising if it were now found that the silver were of even greater importance than the barite, especially since it has been found that native silver and argentite are present in the tunnel run on the vein, in which, at the time that the work was performed, no silver was reported. This company will rank as one of the pioneers in the development of Northern Ontario, there being, as far as we know, no other similar deposits in Northern Ontario.

A newspaper despatch from Atlin, B.C., published about the middle of February, stated that the cold weather had abated and miners on all the Atlin creeks were commencing work again, while it was expected the placer-mining plants would soon again be in operation.

SWASTIKA.

The Swastika Mine has been temporarily closed down.

MINERAL PRODUCTION OF BRITISH COLUMBIA, 1914-15

The following table shows the quantities and value of the several minerals produced in the year 1914, and the estimated production in 1915:

	Production, 1914.		Estimated Production, 1915.			
	Quantity.	Value.	Quantity.	Value.	Increase.	Decrease.
Gold, placer		\$ 565,000		\$ 745,000	\$ 180,000	.....
Gold, lode, oz.....	247,170	5,109,004	244,378	5,051,293	.....	\$ 57,711
Total gold		\$ 5,674,004		\$ 5,796,293	\$ 122,289	.....
Silver, oz.	3,602,180	1,876,736	3,434,393	1,621,393	.....	\$ 255,703
Lead, lbs.	50,625,048	1,771,877	45,990,372	1,917,799	145,922	.....
Copper, lbs.	45,009,699	6,121,319	57,905,488	10,006,068	3,884,749	.....
Zinc, lbs.	7,866,467	346,125	13,817,808	1,554,503	1,208,378	.....
Total value of metalliferous		\$15,790,061		\$20,895,696	\$ 5,105,635	.....
Coal, tons (2,240 lbs.).....	1,810,967	6,338,385	1,546,664	5,413,324	.....	\$ 925,061
Coke, tons (2,240 lbs.).....	234,577	1,407,462	248,424	1,490,544	83,082	.....
Building materials, etc.....		2,852,917		1,500,000	.....	1,352,917
Total value of production.		\$26,388,825		\$29,299,564	\$2,910,739	.....

PROFITS OF BRITISH COLUMBIA MINING COMPANIES.

The following statement shows the dividends declared by metalliferous-mining companies during the calendar years 1913, 1914, and 1915:

Name of Company.	1913.	1914.	1915.
British Columbia Copper Co., Greenwood.....	\$ 88,756	.....	.....
Consolidated Mining and Smelting Company, Trail.....	348,264	\$464,376	\$493,425
Granby Con. Mining, Smelting and Power Co., Grand Forks.....	899,911	449,955	449,955
Hedley Gold Mining Co., Hedley.....	360,000	300,000	300,000
Le Roi No. 2, Ltd., Rossland.....	43,830	.....	58,440
Rambler-Cariboo Mines, Ltd., Three Forks.....	.....	.....	35,000
Standard Silver-Lead Mining Co., Silverton.....	650,000	475,000	250,000
Totals.	\$2,390,761	\$1,689,331	\$1,586,820

MINE-VENTILATION STOPPINGS.

The United States Bureau of Mines, Department of the Interior, in co-operation with the State of Illinois, has just issued Bulletin 99, "Mine-Ventilation Stoppings, with Especial Reference to Coal Mines in Illinois," by R. Y. Williams.

The author draws the following conclusions from his investigations:

"One of the most obvious conclusions from the inspection of several hundred stoppings is that the efficiency of a mine stopping to prevent the leakage of air depends more on the care with which the joints are made than on the material that is used in construction. Some concrete stoppings were found to leak large quantities of air because they were not set into the rib, and new tongue-and-groove stoppings were tight when carefully constructed. The amortised first cost is a small item compared with the maintenance and efficiency charges, and the cost of cutting a latch in the rib is only a small part of the initial expense. The preparation of grooves in the ribs should therefore always precede the erection of stoppings.

"A general protest is being made against high velocities in the ventilating currents in coal mines. The practical facts on which this protest is based are as follows:

"The amount of power required to move a given volume of air increases directly as the cube of the velocity. If leaky stoppings make it necessary for the fan to deliver four times as much air as would be required if the stoppings were tight, the cost of the power to move the larger volume of air would be sixty-four times that for the smaller volume.

"As the temperature and the relative humidity of the upcast at any mine are approximately constant throughout the year, the quantity of moisture extracted from the dust will vary directly with the quantity of air in circulation. If, therefore, the fan furnishes four times as much air as would be required if the stoppings were efficient, the amount of water extracted from the mines during cold weather would be increased nearly fourfold. The drying out of coal mines in the winter causes a dangerous condition to exist in the event of a blown-out or windy shot or the ignition of a pocket of gas.

SILVER PRICES.

	New York, London,	
	cents.	pence.
February—		
22.	Holiday	27
23.	57	27 ¹ / ₁₆
24.	57	27 ¹ / ₁₆
25.	57	..
28.	56 ⁷ / ₈	..
29.	56 ⁷ / ₈	26 ¹ / ₁₆
March—		
1.	56 ⁷ / ₈	26 ¹ / ₁₆
2.	56 ⁷ / ₈	27 ¹ / ₁₆
3.	56 ⁷ / ₈	27
4.	56 ⁷ / ₈	27
5.	56 ⁷ / ₈	26 ¹ / ₁₆
7.	56 ⁷ / ₈	27
8.	56 ⁷ / ₈	27
9.	56 ⁷ / ₈	27
10.	56 ⁷ / ₈	..

MARKETS

NEW YORK MARKETS.

March 10, 1916.—Connellsville Coke—

Furnace, spot, \$3.75 per ton.

Contract, \$3.00 to \$3.25 per ton.

Foundry, prompt, \$3.75 to \$4 per ton.

Contract, \$3.50 to \$3.75 per ton.

March 10, 1916.—Straits tin, f.o.b. nominal, 56 cents.

Copper—

Prime Lake, nom., 27 to 27.50 cents.

Electrolytic, nom., 27 to 27.50 cents.

Casting, nom., 25.50 to 25.75 cents.

Lead, Trust price, 6.60 cents.

Lead, outside, 6.87½ to 7.12½ cents.

Spelter, 17.17½ to 17.42½ cents.

Antimony—

English brands, nominal.

Chinese and Japanese, 44 to 45 cents.

American, 44 to 45 cents.

Aluminum—nominal.

No. 1 Virgin 98-99 per cent., 58 to 60 cents.

Pure 98-99 per cent, remelt, 56 to 58 cents.

No. 12 alloy remelt, 47 to 49 cents.

Nickel, 45 to 50 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$250.00.

Platinum—nominal, \$88.00.

Cobalt (metallic), \$1.25.

Silver (official), 56¾c.

Metal Products.—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:—

Sheet copper, base, 34.

Copper wire, base, 28.75 to 29.25.

High sheet brass, base, 38 to 40.

Seamless brass tubing, 42 to 44.

Seamless copper tubing, 43 to 45.

Brazed tubing, 46.50 to 48.50.

Brass wire, 38 to 40.

Brass rods, 38 to 40.

Sheet zinc, f.o.b. smelter, 25.

TORONTO MARKETS.

March 14—(Quotations from Canada Metal Co., Toronto)—

Spelter, 25 cents per lb.

Lead, 10 cents per lb.

Tin, 55 cents per lb.

Antimony, 45 cents per lb.

Copper casting, 31 cents per lb.

Electrolytic, 31 cents per lb.

Ingot brass, yellow, 13c.; red, 15 cents per lb.

March 14.—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto.)

New York Curb.

March 11, 1916.

	High.	Low.	Close.
Alaska Gold	22¾	17¼	22
Allis-Chalmers'	31¾	28¾	30
American Smelters	103½	97¾	101¾
American Zinc	89	79¼	87
Anaconda	87¾	85¾	86½
Bethlehem Steel	495	467	488½
Butte & Superior	105¼	94¾	96
Canadian Pacific	166¾	164¼	164½

Chile Copper	23¾	22½	22¾
Chino	57¾	55½	55½
Colorado Fuel	44¾	41	44¼
Crucible Steel	86	73¾	84½
Erie	37¾	36	36¾
Goodrich	73½	70¼	72¾
Great Northern Ore	44¾	41¾	43¾
Inspiration	47	44¾	46¼
Kennecott	57¾	54¾	56
Lackawana Steel	78¾	75¼	77
Miami	36¾	35¼	36¼
National Lead	69¾	66¾	67½
U. S. Steel	84¾	81¾	83¾
Utah Copper	86½	83	83½

STANDARD MINING EXCHANGE.

March 11, 1916.

Cobalt Stocks.

	Ask.	Bid.
Bailey	.06	.05½
Beaver Consolidated	.37½	.36
Buffalo	.95	..
Chambers-Ferland	.23½	.21
Coniagas	4.12½	..
Crown Reserve	.43	.42
Foster	.11½	.11
Gifford	.06½	.06
Gould	.01	¼
Great Northern	.04¾	.04½
Hargraves	.06¼	.05½
Hudson Bay	..	26.00
La Rose	.64	.62
McKinley-Darragh	.40	..
Nipissing	6.50	6.25
Ophir	.05	.04
Peterson Lake	.26	25¾
Right of Way	.05	.04¾
Seneca Superior	.65	.52
Silver Leaf	.02¾	.02¼
Shamrock Con.	.17	.15½
Timiskaming	.53½	.53
Trethewey	.17	.12
Wetlaufer	.10	.08
York Ontario	.02	.01

Porcupine Stocks.

	Ask.	Bid.
Apex	.06	.05¾
Dome Con. M.	..	.15
Dome Extension	.37	.36¾
Dome Lake	..	24½
Dome Mines	..	24.75
Foley O'Brien	.55	.50
Gold Reef	.02	.01½
Homestake	.55	.45
Hollinger	27.00	26.80
Jupiter	.21¾	.21½
McIntyre	.92½	.92
McIntyre Extension	..	.27
Moneta	.12	.10
Pearl Lake	¾	¼
Porcupine Crown	.77	.73
Porcupine Gold ex-r.	..	½
Porcupine Imperial	.03¼	.03
Porcupine Tisdale	.02	.01½
Vipond	.60	.59
Preston East Dome	.04¼	.04
Schumacher	.46	..
Teck-Hughes	.20	.19½
West Dome	.15	.14½
West Dome Con.	.22½	.22

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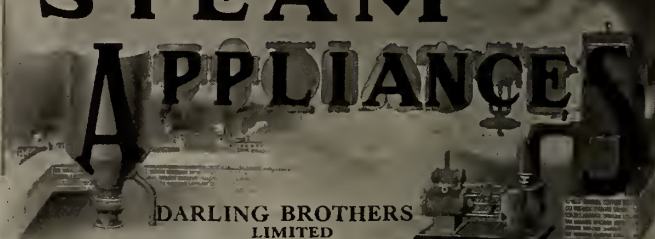
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VOL. XXXVII

TORONTO

No. 7

In This Issue:

*Sir Thomas White on Taxation of
Mining Profits.*

Coal Production and Munitions.

Flotation Processes.

*Production of Non-Metallic Minerals
in 1915.*

What Mr. Maclean Believes.

CANADA

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MINES BRANCH

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- The Copper Smelting Industry of Canada. Report on, by A. W. G. Wilson, Ph.D.
- Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.
- The Bituminous Sands of Northern Alberta. Report on, by S. C. Ellis, M.E.
- Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.
- Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.
- The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.
- The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.
- Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.
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- Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
- Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
- Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
- Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.
- Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.
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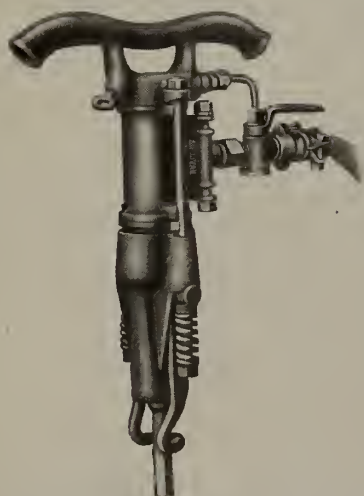
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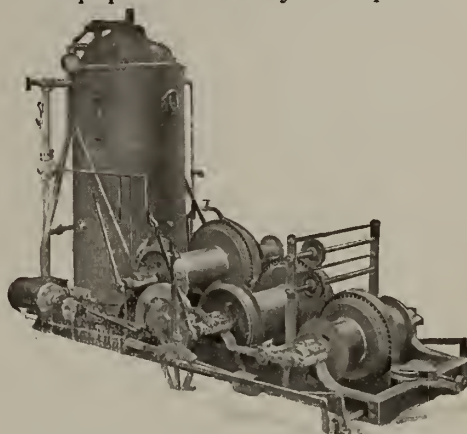
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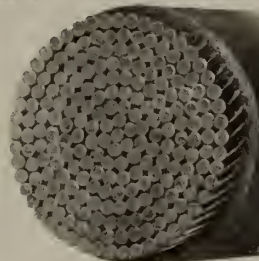
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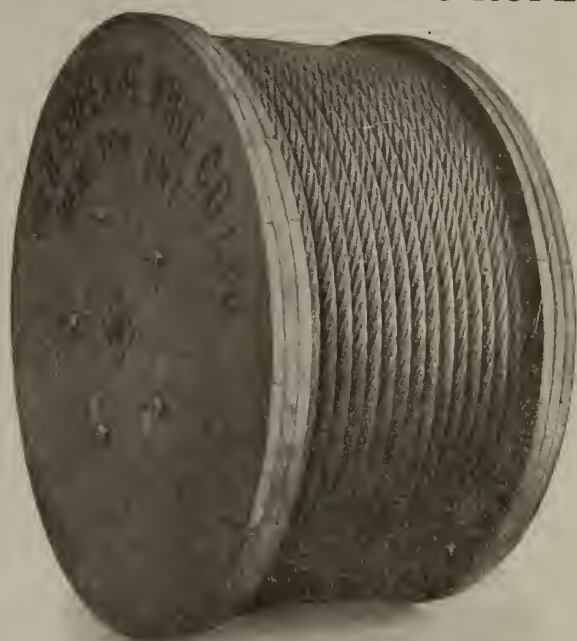
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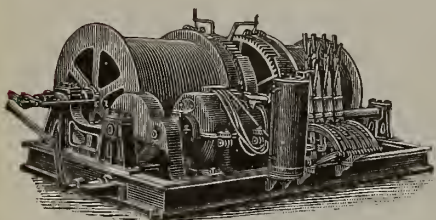
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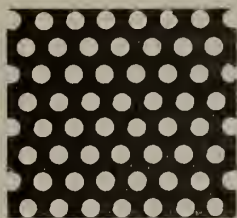
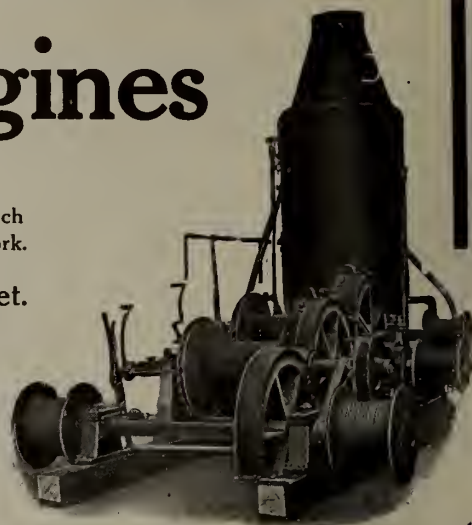
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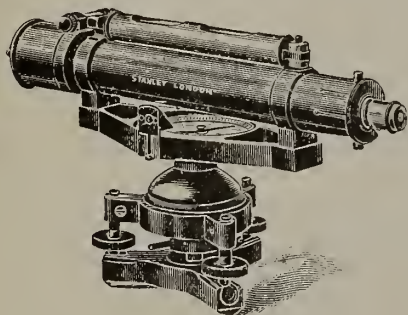
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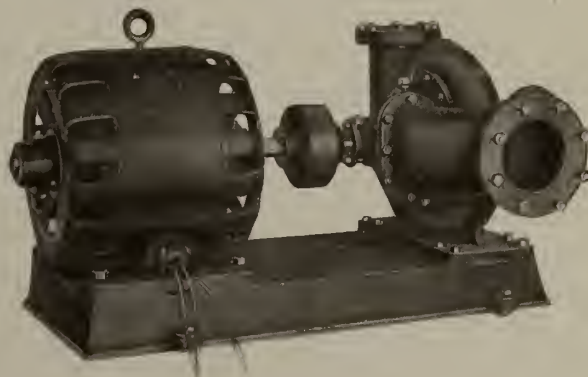
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MISMANAGEMENT OF THE COAL MINING INDUSTRY

The demand for coal is at the present time of the most insistent nature, and all the collieries of the Province of Nova Scotia are producing the greatest amount of coal that is possible with the greatly depleted number of workmen that the call to the colors has left at the mines. In comparison with the production of this time last year, outputs show up very well indeed, but as has been previously pointed out, production in the early part of 1915 was at a low ebb.

The treatment given to the coal producers of Nova Scotia by the authorities would lead to the inference that the importance of the coal industry is but little recognized by those who are directing the policy of the country. The old proverb, "Nothing like leather," is no doubt applicable to coal men, as it was to the ancient cobbler, but surely some consideration should be granted to the industry which produces the basic munition of war, the one article without which modern warfare is impossible, the absence of which immobilizes both the men and the guns.

The mining population of Nova Scotia has given about 24 per cent. of its bread-winners to the colors. No other industry has given anything like this proportion. The loss in coal production, reckoning the productive capacity of the men who have enlisted at the low figure of 2½ tons per man per day, will figure out at about 8,700 tons per day, equivalent to 200,000 tons a month, or close to 2,500,000 tons per year. Canada produces but 15,000,000 tons per annum. The unwisdom of allowing the coal production to fall off in this alarming manner should be apparent to the meanest intelligence. Of course, as was to be expected, the reduction of the coal production is being severely felt in Eastern Canada, but the present stringency is a state of plenty compared to what is coming in a few months from now.

The Canadian Government has announced its intention to raise 500,000 men for overseas service out of a population containing approximately 1,300,000 men of military age. Lord Shaughnessy has had the sanity and the courage to point out that this can only be accomplished by drafting women into the occupations now followed by men. The Canadian woman, in case of need, will doubtless be found as willing to take up men's work as the women of Great Britain and France have been, but it has not yet been suggested that women should go underground to work in the mines. Women work on the pitheads in Great Britain and in Europe, but it cannot be too strongly pointed out that the men who have enlisted from among the colliery workmen of Nova Scotia are overwhelmingly under-

ground men. It is within the mark to say that 95 per cent. of the enlistments from the collieries have been from among the men who work at the coal face, from among the drivers and haulage men, the mine officials and other underground workers, and that the enlistments from surface workers are so small as to be negligible by comparison with the underground workers.

Great Britain does not import a pound of coal, and she is yet the world's greatest coal exporter, although not the greatest producer of coal. This goes a long way towards explaining why "the folks at home" are able to keep up the financial end of this war. But here in Canada, we do import coal, we import more than we mine, and if things go on at the present rate we look like importing very much more than ever before. That is to say, we are going to send Canadian money out of the country to buy American coal, and thereby set up an adverse trade balance against ourselves, and at the same time allow our own coal industry to languish and decline.

One would have supposed that the first care of an intelligent Government would be to increase production of all raw materials in the country, and particularly to aid those two persons who are our chief producers of basic materials, namely, the farmer and the miner.

What is coal chiefly being used for to-day in Eastern Canada? Everybody knows. It is being used in the manufacture of munitions, the operation of railroads carrying and assembling said munitions, and the conveyance of troops from training camps to the battle-front. We make shells in Canada, and are not slow in blowing a trumpet to tell the world how quickly, cheaply and well we make these shells. Reams and reams of *Hansard* have been filled by protests against the letting of shell-fuse contracts in the United States, and politicians indignantly ask why these delicate little mechanisms cannot be just as well made in Canada. But where is the logic of howling about shell and time-fuse contracts if we allow the coal production of the country to decline by millions of tons annually, and buy this basic and absolutely necessary raw material in the United States? By doing so we strike at the foundation of munitions manufacture and impoverish ourselves.

The man who would discourage recruiting in this time of great national peril is a fool and a traitor, but he is neither who recognizes that this war is as much an economic fight as a fight between armies. If the Russians could have overrun Silesia when they were hammering at the gates of Cracow many months ago, the German collapse would have come before this, because Silesia is the great coal field of Germany. It is only because of the British Navy and the fact that France can draw upon Great Britain for coal and iron that our gallant Ally has been able to wage such vigorous warfare against the invader of her northern coal and iron fields. To those who direct recruiting in Canada several significant facts might be pointed

out, namely—no coal miner can enlist in Great Britain or be sent to the front in France if his labor is required to produce coal. Men have been sent home from the trenches to dig coal, and most ironical of all, miners from British Columbia were sent to England to help the coal production there. It is reported that in Germany, prisoners of war, among them British and Canadian prisoners, are being compelled to mine coal in German collieries. Our enemies are under no misapprehension as to the value of coal. Every foot-pound of energy liberated in the terrific artillery onslaught on the Germans upon Verdun was derived in some way from coal.

It is not a coincidence that the much discussed industrial renaissance of Eastern Canada is concentrated in and largely confined to the territory served by the soft coal mines of Nova Scotia. Not only has the supply of soft coal been imperilled by the disproportionate recruiting among the underground workers, but requisitioning of coal carrying steamers has taken place upon a drastic scale, with such serious consequences to Halifax and St. John, N.B., that the representatives of these cities have protested in the House at Ottawa. The reply given to these protests was that Great Britain had to supply transportation, not only for the Empire, but for our Allies also. No one will deny the urgency of the transportation question, because as it was expressed in the House of Commons in London, it is a case of trying to put a quart into a pint bottle. But if the requisitioning of Canadian coal carriers hampers the Canadian railways in the transportation of munitions, delays troopships and transports, and restricts the output of munitions factories, what are we advantaged as an Empire?

It is difficult when discussing this matter to avoid becoming querulous, but surely it should soon commence to dawn upon our leaders that there is nothing more important in connection with the war at the present time than the maintenance of the coal production of Canada. Men are a negligible consideration by comparison, for without coal men can neither be supplied with arms and clothing, nor transported to the front.

It has been stated in the House of Commons in the debate on the war tax that excluding the nickel companies only 24 mining companies paid dividends in 1915. This statement is hardly correct as there are some companies paying or capable of paying dividends that are not included in the lists which we have published.

The incorporation of the Hudson Bay Zinc Co., with a nominal capital of \$5,000,000 in 1,000,000 shares of par value of \$5 each, has been gazetted at Victoria, B.C. The chief object of the company is to acquire from Messrs. Maurice W. Bacon and W. E. Cullin, Jr., of Spokane, options to purchase 14 mineral claims near Salmo, B.C., including the H.B., Leadville, Zineton and other mining properties.

THE TAX ON PROFITS

The debate in the House of Commons on March 17th was of unusual importance to mining men. We reprint elsewhere in this issue several extracts from the official record of the debate and we suggest that anyone who feared, as from our editorial of March 1 it can be seen we did, that the mining companies were to be burdened with far more than a just share of the war tax, should read Sir Thomas White's explanation.

It appears to us now that the Minister of Finance is making provision for fair treatment of the mining companies and that the industry will not have to bear more than a reasonable share of the war tax. If a profit of seven per cent. of the actual value of each company's assets is exempted from taxation and allowance is made for mineral exhaustion, the balance of profits taxable under the Act will be comparatively small. A tax of 25 per cent. of that balance of profits will not seriously affect the industry.

As we interpret Sir Thomas White's statement, shareholders of mining companies operating in Canada have good reason to believe that the war tax has not very seriously affected the value of their investments. The depreciation on the exchanges which followed the first report of the Budget speech was a natural one which would be warranted if the Minister's satisfactory explanation had not been forthcoming. Much lower values would doubtless have been registered if early assurances had not been given that the tax was not to be as heavy as the Budget speech indicated.

In our last issue we urged that while assurances given were satisfactory to us, announcement of a definite limit should be made by the Government. With the speech of March 17th now before our readers, we feel now that such an announcement is unnecessary.

While the war tax to be levied will yield from the mining companies a total that will be no mean contribution from the industry, we can agree with Sir Thomas in concluding that it will not be so large as to cripple the industry or drive away capital seeking investment in Canadian mining properties. Investors were warranted in hesitating until a satisfactory explanation was forthcoming, and mining company directors had apparently good cause for uneasiness as to the effect of the Minister's proposals; but the manner in which Sir Thomas has met the criticisms of mining men should restore confidence.

It is noteworthy that of the 24 dividend paying mining companies mentioned by Sir Thomas White, 20 are gold or silver producers and consequently can by no means be classed as companies making profits on account of increase in prices of products owing to the war.

Teck-Hughes Gold Mines Limited is creating a \$500,000 five-year seven per cent. first mortgage bond issue, of which \$100,000 par value is now offered to the shareholders at \$2, and accrued interest.

THAT REPORT ON OIL AND GAS

Mr. Clapp's reply to our criticism of Volume II. of the Petroleum and Natural Gas Resources of Canada, does not appear to us to be satisfactory or convincing. Probably it would be better to consider the different points urged by him in order.

In the second paragraph of his letter, the ample margin is defended on the grounds of improved appearance. We criticized it as one of the evidences of a desire to unduly expand the size of the volume. We might have mentioned others, such as some of the photographs of doubtful value given on page 274 and following ones, including two dry holes and a pile of pipe at a railway siding. As a number of these are $2\frac{1}{2} \times 4$ inches and the page is $9\frac{3}{4} \times 6\frac{1}{4}$, two pictures could easily be printed on one page, and there is no reason why both sides should not be utilized. If this were a volume of spring poems printed as an edition de luxe, the ample margin and the prodigal use of paper would be pleasing. We objected to these devices as unnecessarily increasing the volume of the work. If, as stated in the following paragraph, the appropriation for the Department is too small, there is all the more need to avoid this useless expense.

We think that it can be shown that the deficiencies complained of were not inevitable and that no great effort was necessary to secure a far greater degree of accuracy.

In our criticism we dealt with the oval shape of both gas and oil pools found in the map of Ontario. It is no answer to say that this is generally the shape elsewhere, even if that were true. It is nonsense to say that it was necessary to generalize the boundaries to the extent to which this has been done. There are in many cases old fields which are nearly exhausted and there are plenty of data to outline the gas or oil areas with much greater accuracy than has been done in the volume under discussion, as will appear later on.

Mr. Clapp seems to assume in the next paragraph that the author of a volume such as this has a right to expect that he will find most or all of the material available in existing reports. There are other sources of information, however, such as the plans of the fields kept by nearly all the important producing companies. There is also the simple plan of taking some kind of a vehicle and an intelligent driver who has a local knowledge of the territory, and noting the position of the wells drilled. Moreover, even when there is a map in existence it has not been correctly copied in the volume under discussion. Thus, in the map of the Kent Gas Field published in Vol. XIX. (1910) referred to in Mr. Clapp's letter, the boundaries of the gas field are shown extending out into the lake, and it was pointed out in the text of that report (p. 150) that the gas area probably extended under the lake some distance. No wells existed in the lake at that time in this place, contrary to Mr. Clapp's statement. These were not drilled before 1912 (p. 43, Vol. XXII. Ont. Bur. of Mines, Rep.).

On the following page of the same Report it will be noticed that 62 per cent. of the entire production of gas from Ontario in that year was derived from the Kent field, and it will later on be shown that over 80 per cent. of the total gas for Canada was produced in Ontario in that year. Consequently, half of the total production from Canada was derived from this small area. It is worth while, therefore, to make some effort

to accurately define this field. In the 23rd Report of the Ontario Bureau of Mines, this gas area is shown in two maps, both on large and small scale, extending out into Lake Erie. On p. 241 it is made clear how important the extension under the lake is. This report was issued more than a year before Mr. Clapp's, and yet on the map criticized the gas field stops at the lake shore.

The explanation which is given in the next paragraph, about the omission of certain pools as they were unimportant, does not meet the criticism that the important area extending along and out into the lake in the Townships of Walpole and Rainham is shown as a blank.

The statement in Mr. Clapp's letter that there were only four small producers in Wentworth County does not agree with the information given on p. 222 of the volume under discussion, which is that no well (in Wentworth) has ever produced gas or oil in paying quantities. Allusions to finding of gas in Wentworth County can be found in the following Reports of the Ontario Bureau of Mines, viz.: Vol. 21, p. 37, where it is stated that out of 254 producing wells drilled in the eastern part of the Province in 1911, 9 were in Wentworth County. Again, on p. 46, Vol. 22, which deals with the operations of 1912, the development of a field in Binbrook Township is referred to (incorrectly put in Welland County). In Vol. 23, dealing with operations of 1913, on p. 37, in the list of Natural Gas Producers, Wentworth County is given as one of the localities in which wells are situated in connection with two companies. On p. 36 of the same report this appears: "The old Welland-Haldimand field was extended by drilling a number of wells in Binbrook Township, Wentworth County. This was the most interesting feature in connection with gas in the eastern part."

If our authors will not utilize the data obtainable we have a right to expect that they will at least read their own work. This shows that there were wells in Wentworth County, and absolutely contradicts the information given on p. 222, Vol. II. Thus, in Vol. I, Table V., opp. p. 40, Wentworth County is mentioned in the column entitled "Location of Wells," in connection with the Dominion Natural Gas Co. Many of us as children have played a game where a number undertake to write part of a story, each one writing his or her portion without seeing what the others have written. This is then put together as a continuous story. Perhaps this volume was written in that way.

Mr. Clapp makes the suggestion that we should read Westcott's Handbook of Natural Gas to settle a question of the composition of gas. C'est a rire, as the French would say. His use of this book for this purpose reminds us of the text "And if the blind lead the blind both shall fall into the ditch," Matt. 15:14. This handbook of Westcott's is concerned almost entirely with the mechanical details of field work in connection with natural gas and cannot in any way be regarded as an authority on the composition. The very first paragraph of the preface is as follows: "The need for a Hand Book containing authoritative information on High and Low Pressure Construction in the Use of Natural Gas, and providing information and suggestions of a practical nature for those engaged in field work is responsible wholly for the publication of this Volume." The author of this work had a little touch of voluminosis, too, and a number of analyses of natural gas are given, just as in Mr. Clapp's Volume, without any particular knowledge or discrimination, and also, just as in the work under criticism in some cases not even correctly copied. Thus, on p. 42 (1913 edition) an analysis is given as follows:

Carbon dioxide.....	.1
Carbon monoxide	.4
Oxygen	.3
Heavy hydrocarbons	.1
Ethane	.1
Methane	14.35
Nitrogen	3.95
Total paraffins	95.05

Any one who has given any thought to the composition of natural gas would know at a glance that this is an absurd analysis. The original of this analysis is No. 5 on p. 556, West Virginia, Geol. Sur. Vol. Ia., and is given as:

Carbon dioxide	0.1
Carbon monoxide	0.4
Oxygen	0.3
Hydrogen	0.1
Heavy hydrocarbons	0.1
Ethane.....	14.35
Methane	80.70
Nitrogen	3.95
Ammonia, etc.	none
Total paraffins	95.05

A similar blunder is made in copying five consecutive analyses, in Westcott's book.

Plenty of analyses can be found showing hydrogen. The point is that the appearance of hydrogen and the other things mentioned is due to a faulty mode of analysis. This should be known to those who write works treating of natural gas. It is fully dealt with in Bulletin 42, U. S. Bureau of Mines, which is the work of two chemists with long experience in this line. Moreover, as we are concerned with gas in Canada and about 40 analyses of natural gas from Ontario are given in the 23rd Report of the Bureau above referred to, and the absence of hydrogen, etc., is demonstrated, it might have put our authors on their guard. It is rubbish to say, as Mr. Clapp does, that numerous analyses are important, unless it can be shown they are correct. Such material is only important to one who is seeking volume and cares nothing for accuracy.

We have already referred to the fact that most of the gas and oil fields in Ontario are fairly old, with limits defined and easily and quickly capable of a much more accurate representation than is given on the map we criticized. From the remarks in the last paragraph one would have the right to infer again that the authors have not read their own work. We sympathize with their evident aversion in this matter. Thus on p. 41, Vol 1, the production of natural gas for 1912 (the last year for which statistics are given) for Canada as a whole and Ontario separately, is put at approximately 15¼ and 12½ billion cu. ft., respectively. The Ontario production is accordingly over 80 per cent. of the total. For the same year 243,614 barrels is given as the yield of oil for the whole of Canada (p. 40, Vol. 1). The Ontario production was 240,935 barrels (p. 22, Vol. 2). This is nearly 99 per cent. of the total.

It will be noticed that we have taken the liberty of making a correction in Mr. Clapp's work. As acknowledged, the table on p. 229, referred to, is taken from the Vol. XXII., Ont. Bur. of Mines Rep. (p. 42). In some way the barrels of oil that appeared in the Ontario Report have been changed into an equal number of dollars, although the value of the barrel in that year according to the Ontario Report, was \$1.43. This is only another instance of the inability of our coterie of authors to even copy existing information correctly. If it can be shown that the territory which is responsible for over 80 per cent. of the production is inaccurately treated, it is a very poor defence to say that the rest might be right. In fact, no one would have the patience to look at the rest.

CORRESPONDENCE

Editor, The Canadian Mining Journal:

Sir.—In The Canadian Mining Journal of February 15, 1916, you make certain criticisms with reference to Volume II. of The Petroleum and Natural Gas Resources of Canada. Since the undersigned is mainly responsible for that report, he feels it only fair to himself, his associates, the Director of Mines, and to the public, to correct the misleading impressions given by your editorial.

Nothing can be gained by more than mentioning your denunciation of the ample margin, since this is merely an opinion, and does not affect the value of the volume, except to improve its appearance. In considering the size, however, please bear in mind that Canada is a large country, having petroleum and natural gas resources in many districts, so that a complete discussion of them would occupy many volumes. The undersigned and his associates, at the request of the Director of Mines, and at financial sacrifice to themselves, cheerfully compiled Volume II. as a summary of conditions affecting oil and gas development in the Dominion; and while no summary can at this time be made absolutely accurate, it is the only one published on the subject.

So far as accuracy is concerned, the title of your editorial is inaccurate itself, since it refers only to a very small portion of the Petroleum and Natural Gas Report, omitting discussions of the rest, evidently failing to realize that a few deficiencies are inevitable and do not relegate an entire report to the term "inaccurate." All Government appropriations for scientific work are too small; consequently if the Department of Mines had waited authority to pay the full value of a complete oil report, the one under discussion would doubtless never have been made. Data for it were widely scattered and fragmentary, being compiled finally by perseverance and with the assistance of various authorities.

While the oval shape of oil pools is severely criticized in your editorial, such a shape is characteristic of the majority of those throughout the world. Moreover in small scale maps it is necessary to generalize the boundaries considerably, since the collection of full data would require great expense and time. Boundaries are generalized in most preliminary reports on oil fields leaving the details for later reports when the full data become available.

The Ontario map which you condemn so severely is the first map covering all the oil and gas fields of the province, and with the exception of a limited amount of fieldwork, practically the only data available from which to prepare the map was contained in local maps accompanying previous reports, viz.: (1) a map of the Kent gas field, by G. R. Mickle, published on page 150 of the report of the Ontario Bureau of Mines for 1910; (2) the Report of the Geological Survey of Canada for 1898, Vol. XI., Part S, pages 119, 121. and 138; and (3) the map on page 93 of the report for the Ontario Bureau of Mines for 1907. The first-mentioned of these maps, by the way, does not show any of the wells which existed in Lake Erie at that time. The last does not attempt to outline the details of the fields, but the fact does not relegate that report to the category of the worthless. Since you appear to have detailed

knowledge of unpublished information on the fields, it is to be regretted that you do not publish it and correct the alleged errors. You may be sure that any corrections or additions will be cheerfully received by the undersigned or by the Director of Mines, and the data will be incorporated in future reports on the subject.

As to the omissions of gas pools in Haldimand, Welland, Norfolk, and Wentworth Counties, it is important to note that certain ones were intentional omissions, since the amount of gas in certain districts is so limited as to be unworthy of representation on a map of fields having commercial value. The undersigned would like to ask you, in reference to your claim that there are "quite a number of good gas wells in Binbrook Township" of Wentworth County, when they were drilled and the amount and duration of their production. The most authentic information received here is that in December, 1914, only four small producers existed in Wentworth County. If your information is more complete than this, kindly supply the details.

Your statement that hydrogen cannot occur in natural gas is interesting. Perhaps you are right, but I would suggest that you read Westcott's "Handbook of Natural Gas," the latest edition of which contains a number of analyses made by reputable chemists which show substantial percentages of hydrogen. If further enlightenment is necessary, please note in the Petroleum and Natural Gas Report, on the same page with the analyses which you criticize, the statement that they were "reported by" certain parties, being quoted merely as contributions, since numerous analyses are important, and no appropriation was available for making them specially for the report.

Your main criticism is evidently directed to the map of the Ontario gas fields. Kindly remember that this is the first general map ever published of these fields, and that a first map of any group of oil fields is never perfectly accurate. If you will carefully read the preface by the Director of Mines, at the beginning of Volume I, you will find, in the first paragraph, a statement that "It was proposed that the monograph should contain a general summary of all the information that was available," by which you will understand that a complete report was not expected on all fields, an impossible undertaking with the time and appropriation available. Turning over two pages, you will next find a letter of transmittal, in which a statement is definitely made that "The report is not intended to enter into exhaustive discussions of individual fields, or to solve all the complicated problems regarding petroleum and natural gas in various parts of the Dominion, since such an undertaking would require years of study and work, but as much detail is included as has been possible in the time allotted, and I trust that the publication may be of some value in the development of the Dominion's resources."

After your scathing denunciation you will certainly pardon the remark that any criticism is narrow and one-sided which devotes itself mainly to details of unpublished information, evidently known to the critic, and relating to a single province, while leaving out of consideration the general character, scope and purpose of the report. Perhaps, by bearing these paragraphs in mind, you will better understand the aims of the authors.

Yours, etc.,

F. G. CLAPP.

New York, March 18, 1916.

ANOTHER PROMISED REVOLUTION

When we read the literature disseminated by some promoters we seldom fail to find strange and wonderful accounts of properties or processes which are to revolutionize the mining industry, and to bring great wealth to those who are invited to subscribe.

We are hardly prepared, however, for such statements when we open the official report of a debate in the House of Commons. Yet Mr. W. F. Maclean, a member of the House, in discussing the refining of nickel, contributes some startling statements. We do not infer from his statements that he wilfully intends to mislead the public. We do not believe that he does. His remarks are, however, likely to prove misleading, and so we direct attention of mining men to them.

The report, in part, of Mr. Maclean's speech is as follows:

"I cannot pass judgment on certain information which has come before me in the last few months, and which has reached its culmination here in Ottawa in the last few days, but I believe that a process of refining not only nickel, but every other metal, has been developed in this country, and most of the work has been done in this city. A wonderful revolution in the process of reducing ores has been worked out, and demonstrated in the city of Ottawa, and with this result: whereas, heretofore, the International Nickel Company had to collect its ore in great heaps at Sudbury and roast it for a period of ninety days, the matte having then to be sent over to New Jersey, by this new method the process can be carried out within forty-eight hours. Instead of the International Company taking 100 pounds of their ore, and roasting it into matte which produces less than five pounds of nickel, by this new method they will be able to get 70 pounds of alloy, in a powder, from the 100 pounds of ore. That powder is then put in a crucible, and gives 50 pounds of metal, which, for convenience's sake, is called after the name of the inventor, Professor Burrows; and that 50 pounds of metal is the equivalent of 50 pounds of nickel in making nickel steel. There is the revolution. It has been effected in our own country, and I believe that it is a fact that out of 100 pounds of our nickel ore we shall get 50 pounds of nickel, which is the equivalent pound for pound of the nickel that is used in making nickel steel. And not only will this process apply to nickel, but to every other ore. The process is largely based on the making of hydrogen gas in a very cheap way out of steam. Any kind of ore can be treated in this hydrogen furnace. I have been following this process now for some months, and I know others who have followed it and who are more competent to pass judgment on it than I am, and the impression that has been made upon me is that this invention will revolutionize the industry."

Mr. Maclean then goes on to discuss what should be done by the Government in order to control the

nickel industry and says, "if there is a new invention in this connection, I would advise the Government to try to get control of it."

We assume that in arousing interest in the nickel question that Mr. Maclean is doing his utmost to further the interests of the Empire and that he really believes that he is showing the Government and the people how to take advantage of an opportunity of adding to Canada's industries and controlling the export of nickel. We have no good reason to doubt his sincerity, but we cannot agree with many of his statements.

Mr. Maclean says, according to the official report of the debate, that "out of 100 pounds of nickel ore we shall get 50 pounds of nickel." That statement is, of course, absurd. It can be put down to an error in reporting or in printing. From his previous remarks we imagine that Mr. Maclean said, or meant to say, "metal"—not "nickel." Otherwise Mr. Maclean would be claiming that the process would result in recovering 50 pounds of nickel from 100 pounds of ore which contained only 5 pounds of nickel.

We have then Mr. Maclean's statement that 50 pounds of "metal" derived from 100 pounds of nickel ore "is the equivalent of 50 pounds of nickel in making nickel steel." As this "metal" would contain only 5 pounds of nickel it would necessarily be chiefly composed of iron, which is the chief metallic constituent of the ores. It would probably contain also about 2 pounds of copper. We may be pardoned for hesitating to accept the inventor's claims so readily as has Mr. Maclean.

When Mr. Maclean goes on to say that "not only will this process apply to nickel, but to every other ore" we regret that we must conclude that only those who know very little about the treatment of ores will have a great deal of confidence in the process or in Mr. Maclean's remarks concerning it.

It may be that the process has some merit and that it will prove of importance in the nickel industry. Mr. Maclean's remarks concerning it, however, do not impress us very favorably.

Seneca-Superior Silver Mines, Ltd., was very successful in 1915, making a profit of \$568,501. The production for the year was 2,047,150 ounces silver. A large profit during 1916 is assured, as the remaining ore is being mined very cheaply. The mine is, however, nearly worked out and unless a new orebody is discovered, and the management holds out little hope for this, Seneca's profitable life will terminate early this year, the mine having lasted less than four years but having produced already over 5,000,000 ounces of silver at an operating cost of 10.6 cents per ounce. The cost per ounce for 1915 was 6.86 cents, a record for the Cobalt camp.

THE TAXATION OF MINING COMPANIES

The debate in the House of Commons on Friday, March 17th, was of unusual interest to mining men. We reprint below extracts from the official report.

Mr. Macdonald: I should like to point out the effect of the imposition of this tax upon every person connected with mining or kindred industries, where the enterprise involves the development of natural resources, and where the development cannot take place except by the employment of capital. The situation has been this.

During the past autumn, throughout Canada generally, there were a great many propositions promoted and on the verge of being capitalized through the assistance of foreign capital, and this legislation will seriously interfere with the consummation of any such capitalization. Indeed, the announcement which my hon. friend the minister made in his Budget speech about a month ago has had the effect of absolutely discouraging any attempt to promote industries of that kind. When a person with a proposition, no matter how good, goes abroad with the idea of obtaining the capital necessary for development, the possible investor inquires whether or not this is one of the companies which would be affected by the Budget of the Government. The person interested would be bound to tell the possible investor that it was one of those companies. It is well that persons should invest with the view of developing coal, silver, nickel, gold or other minerals. The person who invests in an enterprise of that kind, particularly at this stage of the world's history, does so with the hope of making some special profit. He takes bigger chances than are taken in the ordinary financial or industrial company. These deal with settled conditions. Business may vary or fluctuate; dividends may be small or great, but there is always a certain basis on which to proceed. It is the same with an industrial enterprise formed for the purpose of producing some special article used in the country. The production of the article is necessary to meet the needs of the people, and the person who invests in that industry knows that the question of receiving dividends depends upon his being able to produce the article as a saleable commodity, and that the price of the article will furnish him with a reasonable profit. But when a man goes into the mining industry, the conditions are entirely different. There may, or may not, be a large quantity of ore; all that has to be taken into consideration by the person who invests. To a very large degree the investment of capital in the mining industry is a gamble. If my hon. friend is going to throw into the melting pot these propositions, he will create a further menace which will intimate to the outside capitalist that the utmost he can get from his investment, after taking all chances, is 7 per cent., before the Government intervenes to take part of the profit. The minister will see that he is menacing the development of that industry everywhere. In addition to that, the party who is looking for capital is not in a position to assure the possible investor that the Government may not, at a subsequent session, proceed to levy upon that class of industry to a greater degree.* * * Mining is a natural industry in this country, quite as much so as agriculture. We all hope and believe that, particularly in the far northern country, there is an illimitable store of minerals, the development of which will mean a tremendous expenditure for supplies and the increased prosperity of the country at large. This

industry stands apart, as I have said, from the ordinary industrial and financial industries. It requires special consideration. I submit that the minister's proposal menaces the future of this industry, and that the slight amendment which he has made in no wise does away with the possibility of injury.

Sir Thomas White: I am really obliged to my hon. friend from Pictou for bringing up this matter for discussion. I need not say that I appreciate the benefit of his views upon any subject that may be under debate in this House. He has put forward his representations very temperately, and I propose to answer them as fully and frankly as I may be able. I think that my hon. friend and those connected with the mining industry, or I should rather say some of them, are unduly apprehensive as to the effect of this measure upon their industry. The Government is fully aware of the extreme importance of that industry in the national economy of Canada. It is one of the great natural industries, as my hon. friend has observed, and, certainly, the Government would be the last to take any step, unless indispensably necessary in the national interest, which might have the effect of in any way injuring the mining industry, or retarding the flow of capital into this country. I think I shall be able to show before I take my seat that there is no ground for apprehension on the part of the mining community. * * * This particular measure is for a period only. The principle of the resolutions, it would appear to me, indicates that. The principle of the resolutions is in effect that those individuals, firms and companies, which since the outbreak of the war have been able to maintain a rate of profit beyond what we have fixed upon as a fair and normal pre-war standard, shall contribute a fraction of that excess for the purposes of the war. It is a fact with regard to many businesses in Canada that the largest profits resulting from the war, either directly or indirectly, have been made, during the 18 months since the outbreak of the war, by reason of the increase in the price of commodities, due to the demand which arose by reason of the outbreak of hostilities, and in supplying of munitions and other requirements in connection with the war itself. I do not mean to say that if the war goes on there will be a less demand for commodities and munitions, but I do not think that, as the country becomes better organized to meet the new conditions, the prices which obtained during the past 18 months will obtain in the future. Therefore, it would seem to me that I am perfectly justified in stating, as I do, on behalf of the Government, that this is a temporary tax. In making that statement, I largely meet the argument of my hon. friend that capital might be discouraged from embarking upon Canadian enterprise. It is hardly conceivable that an enterprise could be established within the next few months, and before the termination of this legislation, earn such large net profits that the moderate tax which we are taking from them would be a serious matter to the individual, firm, or company in question. Therefore, I do not believe, for myself, that when it is realized, as I believe it is now realized, that this is a temporary measure, the effect which my hon. friend anticipates will be produced, or will continue, if such an effect has already been produced. * * * I want those who can afford to pay, to pay. There is no one who will be taxed that cannot afford to pay, and I know of no one who is not willing to pay. In fact, I know the people are anxious to pay the tax imposed by this budget.

This measure, therefore, being a temporary measure, it is not conceivable to me, when it is understood, that it will have any effect in retarding the flow of capital towards this country. Let us assume for a moment, however, that it would; let us assume that my hon. friend is right, and that it would have some effect in retarding the flow of capital to this country. I ask this House, would that be a good reason for a Government refraining from taking any taxation action that it might deem indispensable towards the winning of this war. Suppose that at the time of the war between the North and the South, when the United States was torn in twain, it had been suggested for a moment that the proposals of the Secretary of the Treasury designed, and necessary, for the prosecution of the war by the North, would have the effect of retarding the flow of capital into the United States; would such a suggestion have been listened to seriously? In Canada today, does anyone consider seriously whether general business is going to be impaired or not? General business is of extreme importance. I yield to no man in my desire that the Government should carry on this war with a minimum of inconvenience to the business of the community. I desire that the war should be carried on, in so far as we can carry it on, with our full power, in such a way as to interfere in the least possible degree with the business activities of this country. I desire that on the grounds of business itself, but I desire it more strongly on the ground that, the more we can promote business, the greater the industrial and commercial activities of the country, the better will we be able to sustain the economic burden of the war. Therefore, in answer to my hon. friend I may say that while I do not believe that the effect of this legislation will be to retard the flow of capital to this country, I am bound to say that the first duty of this country is the conduct of the war, and that business considerations, while of great importance, are really secondary; and I believe the public in this country take that view. * * * The first business of the United Kingdom, of Canada, of Australia, of the Empire, is the war, and when I say that I take second place to no one in stating at the same time that we desire to do everything we can, that we shall omit nothing to promote the prosperity of business in this country, and that we appreciate to the full the desirability of taking no measures, not absolutely necessary in the nation's interest, that will have the effect of retarding the flow of capital into this country during and after the war. * * * We are fighting to protect Canada, to protect the industries of Canada, including among others the mining industry. I have talked with many mining men during the last few weeks and I desire to pay them the tribute of saying that they are willing, they are desirous, they are anxious to pay, and to pay large amounts towards the conduct of this war. Nothing has impressed me more than the attitude of two or three American gentlemen engaged in the mining business in this country. They said: You are asking for one-quarter of one per cent. [Ed.—Should probably read "our profits."] over 7 per cent.; if you want more ask for it and we will give it to you.

Mr. Macdonald: What company was that?

Sir Thomas White: I will give my hon. friend the names privately. These gentlemen would not like to have their names mentioned in the House. My hon. friend is apprehensive about the mining industry. I think he has totally miscalculated the effect of the Bill upon that industry. The principle of the taxation is this: If net profits have been made, in the case of companies, including mining companies, in excess of 7 per

cent., we take one-quarter of the excess and one-quarter only. Does my hon. friend know that, excluding nickel companies, only twenty-four mining companies in the whole Dominion paid dividends last year? My authority is the Canadian Mining Journal.

Sir Wilfrid Laurier: They are not very prosperous, then.

Sir Thomas White: The extraordinary thing is that some were exceedingly prosperous.

Sir Wilfrid Laurier: Only the twenty-four are prosperous.

Sir Thomas White: Others are engaged in the business, but they are not affected by this tax, and many of these are not affected by the tax. The point I am making is that the mining industry has nothing serious to apprehend from this tax. We are fighting for this country, we are fighting for every business in it, including mining. On what principle can I, or can the Government, leave out mining industries from the operation of this tax? On what principle can I tax a manufacturing company, a transportation company, a trading company and pass by the Hollinger mines worth \$10,000,000, or \$15,000,000 or \$20,000,000 and earning up to \$2,000,000 net profits? On what principle can I pass by the Nipissing mine earning \$1,200,000 a year and worth probably \$5,000,000 or \$20,000,000. How can I pass by copper companies in view of the fact that copper has doubled in price since the outbreak of the war? On what principle can I pass by the nickel companies which are making enormous sums out of the natural resources of the country? I appreciate to the full what the mining industry at Cobalt and Porcupine means to the Province of Ontario and I appreciate the importance of the mining industry to British Columbia, but the point I make is that the mining industry is not going to be injured materially by this legislation and I shall show my hon. friend from Pictou that he has misjudged the effect of the legislation upon these mining companies.

I do not believe there is a country in the world in which less revenue is derived from mining than Canada. Take the highly mineralized area in Northern Ontario, Cobalt and Porcupine and other mineralized areas; I was surprised to find the other day that the entire amount of revenue derived by the Province of Ontario from its mineral areas was about \$300,000. It cannot be said that in so far as Canada is concerned there is anything in the situation that would retard the flow of capital towards this country for the purpose of embarking in the mining industry. The Minister of Mines of British Columbia was here the other day and I inquired of him how much revenue they derived from the mines of British Columbia. He informed me that they got \$150,000. I do not know of any country in the world in which such small amounts are taken from the mining industry by way of royalty and taxation as in Canada. I do not believe that the imposition of this moderate tax is going to have the effect, amongst a community as intelligent as the mining community of causing them to slacken their efforts in the development of that great natural resource. We go to the legislation of the United States; the United States is a great mineral country and yet there has been an income tax imposed not only upon the subsidiary mining companies, but upon the holding companies. The maximum allowance made by the United States for exhaustion of capital is only five per cent. I think that is too small, and I shall deal with that phase a little later on. Take the nickel companies of Canada. The International Nickel Company, which has its refining plant in the United States and operates, I believe, through a

subsidiary company at Sudbury, had earnings of nearly \$10,000,000 for the nine months ended December 31st, 1915. Now I do not believe that public opinion would sustain the Government in taxing all other industries in Canada and passing by these mining companies. Mr. Turriff: Was it the International Nickel Company or the Canadian Copper Company that earned the \$10,000,000?

Sir Thomas White: The International Nickel Company. I mentioned the subsidiary company at Sudbury, which is called, I believe, the Canadian Copper Company. I give that as an illustration of the large earnings of these mining companies, and I am going to show later that **the amount we shall take from these mining companies is so small that it will have no appreciable effect on the mining industry at all.** Only comparatively few mining companies in Canada are subject to the tax, and they will contribute very much less than my hon. friend has in view. The mining companies desire to contribute. Some of them would rather that the tax was on a basis so that they would not have to contribute so much; that is no doubt very natural. I hear there are also a few, but very few, who would rather not pay anything at all. But we should not be justified in acceding to their request and exempting them from the operation of this tax, provided of course that they made large profits. I can say this that those in the mining industry who do not desire to pay are decidedly in the minority; the great majority do want to pay; they recognize it as just that they should pay, and among these I am happy to say are the Americans.

Let us for a moment **consider the principle of the application of this measure to the mining industry.** I admit that it is more difficult to apply a measure of this kind to mining companies than to manufacturing, industrial or commercial business. The reason is that mining, as my hon. friend from Pictou has pointed out, is a calling in which there are many disappointments, and in which abnormal profits must be looked for. I think that is generally admitted. A man who might be quite content with seven per cent. in a manufacturing business would not invest in a mining company upon the basis of a seven per cent. return on his investment. It must be borne in mind that a man who speaks of getting say twenty per cent. in a mining company, especially a company that is operating metalliferous mines, knows that in that twenty per cent. there is a large return of his capital each year. That is among the reasons why, in mining, a larger return is required than in the case of an ordinary commercial or industrial enterprise. The same remark would apply to other businesses—I do not say that twenty per cent. would apply—in which the capital invested is depleted from year to year. The resolution I have brought down relates net profits to capital. I would call the attention of my hon. friend from Pictou to the fact that in the resolution originally brought down we used the term "net profits." I may say that mining had not escaped our attention, and for this reason, among others: We had examined carefully the American income tax legislation, in which provision is made for an allowance for exhaustion or depletion of capital not to exceed five per cent. of the gross output in any one year. It did not appear to us that we should place a limit of that kind upon the amount that we should allow for exhaustion of capital. There are some mines whose average life is eight or ten years. I am speaking of metalliferous mines. Then other mines, such as coal mines, last for generations, and the same considerations, except in a general way, do not apply; that is to say, the percentage of exhaustion in a coal mine in a particular year is not so great as the amount of exhaustion in connection

with metalliferous mines such as gold, silver and copper mines. We therefore deemed it improper to place any limit on the percentage which we should allow for exhaustion of the capital of a mine. **In the administration of this Act it may be necessary for us in some cases to say we shall allow (for exhaustion) ten, twelve or thirteen per cent.; and in other cases five, or two per cent. It all depends upon the character of the mine with which we are dealing.** The hon. member for Pictou will, I am sure, concede that if we tax what are known as profits and distributed to shareholders, say under the mining laws of the Province of Ontario, but which are really not net profits, and deduct from those profits a proper amount, as we should be entitled to do under the provisions of this Act, for depreciation of plant and machinery, and for exhaustion, in the case of some mines, to the extent of ten, twelve or more per cent. of the value of the mine, they take on a very different complexion from what are ordinarily understood as profits in the payment of dividends to shareholders in mining companies. The result of dealing with the profits of mining companies in that way—and it is a proper way to deal with them—will be to make the net profits appear to be much smaller than the apparent profits which are published from time to time. So much for that phase.

I have not considered it necessary to place any limit in the Act, because I think in its administration the judgment of the officials should be left unfettered, although, of course, they will have to act on some principle which will be fair to all. I do not, however, consider it necessary to fix in the Bill a limit of percentage to be allowed for the exhaustion of mines. I have dealt with the matter of net profits, and it does seem to me that in dealing with them in that way we are placing the mining industry on a parity with all other industries.

Now we come to another question, which I am sure my hon. friend from Pictou has given attention to: the question of capital, of reserve, rest and accumulated profits. My hon. friend will observe, by an amendment I shall make to the resolution, that "may" will become "shall."

Mr. Macdonald: In all companies?

Sir Thomas White: I would call the attention of my hon. friend from Pictou to the fact that, in estimating capital we shall have regard, not only to capital stock, but to rest, reserve, and accumulated profits. These will all be embraced under capital.

My hon. friend from Pictou is a lawyer, and I desire to make this statement to him: If we had proceeded absolutely logically we should have said: We will take the value of all the assets, real and personal, movable and immovable, of every company, firm and individual in Canada, and subtract the liabilities from the assets and the difference will be the capital. I need not, however, tell the House that that would be a Herculean task for the officials charged with the administration of this measure. In the case of most companies the capital, reserve and accumulated profits are accurately stated in their reports, and one would feel perfectly safe in taking their statement where the capital stock has been paid in full: capital, so much; reserve and accumulated profits, so much, representing premium on the price of stock sold to shareholders, or profits which have been taken into reserve, or contingent fund, or allowed to remain in profit and loss account. So in the case of an ordinary company for the sake of taxation, you have your capital, your reserve or rest account, and your accumulated profits, substantially representing the capital of the company invested in that business.

Mr. Macdonald: The gross capital?

Sir Thomas White: No, the net.

Mr. Macdonald: What about the liabilities?

Sir Thomas White: I think I am right. I am speaking of capital, reserve and accumulated profits only; I am not speaking of the total assets. I say that that substantially represents the capital of that company. Just as an individual has invested in a business \$100,000 which would represent the value of its assets less its liabilities, so, in determining what the capital of a company logically is, you would say: What is the value of its assets and what are its liabilities? You would then deduct the liabilities from the assets and in that way get the capital. If the business of a company has been conducted properly, if the stock has been all paid in cash, you will find that that will correspond with capital stock, rest, reserve and accumulated profits.

Mining companies present difficulties in ascertaining the capital invested in them, because there is no necessary connecton between the nominal capital of a mining company and its real capital, which is the value of its mines. Therefore, you will find these anomalies.

You will find a company incorporated some years ago, say, with a capital of \$250,000 or \$500,000, and you will find that the property to-day may be worth \$5,000,000; that a holding company has probably been created, holding the stock in the original company, now the subsidiary company of the holding company, and that the dividends are being paid, say at the rate of 15 or 20 per cent. upon a capital of \$5,000,000. Now, this taxation will apply, of course, to the underlying company; but it will be necessary, in order to be perfectly fair to the mining industry, that in considering what its capital is, under the provisions of this Bill, you have regard to the amount of its fully paid up capital and to the values of its reserves, rest and accumulated property, the three together, as I have stated, representing substantially the value of the mine. In my opinion, that is absolutely fair and just, and it is the principle that would be applied to financial institutions, private individuals and firms in business. The first question is: What is the true amount of your capital? The second is: What is the true amount of your net profits? Now, relate your net profits to the true amount of your capital and you will easily be able to make the calculations called for in this measure. Therefore, I think, in view of the statement I have made, that the apprehensions of those engaged in the mining industry that this tax is going to be oppressive, will be allayed, if not entirely removed, because, on the one hand, the so-called profits are cut down to a net basis, and on the other hand, the capital, reserve and accumulated profits are deemed to be the value of the property, less the liabilities, of course, that is, the true capital invested in the enterprise.

I do not, at the moment, desire to say anything further than this, that, if these resolutions and the Bill which I shall introduce later should meet, as I believe they will, with the approval of this House, it will be our object to administer this legislation, while strictly, in accordance with the legislation, with good judgment and with scrupulous fairness to all parties concerned. The administration will be under the Department of Finance, the tradition of which I believe has been good, and I certainly desire to pass it on unimpaired. It has been suggested here that political considerations might enter into the administration of this measure. I do not believe that that view is shared in by a majority of the members of this House, nor that it is shared in by hon. gentlemen opposite. We are bringing in an exceptional measure under exceptional conditions, and

the House realizes the fact that this is a Bill that under normal conditions would not be brought down. I am sure hon. members will have confidence that this measure will be administered fairly and justly to all parties concerned, and most certainly without regard to political considerations in order that the end may be accomplished that we have in view in introducing this measure, namely, that we may raise a substantial amount of revenue to cover our expenditures in connection with the war.

Perhaps I have spoken longer than a minister should in committee; but the hon. member for Pictou, I know, is sincerely interested in this matter; he has a wide interest in mines; he is sympathetic to the mining industry; he is well informed; he has put forward his views; he has raised questions; he has made representations, and I have thought that his desire was that I should deal with this matter, so that those engaged in the mining industry may be reassured as to certain matters about which they have been in doubt, namely as to what net profits mean and as to what capital means in connection with their industry.

There is another thing. My hon. friend has touched upon the question of the certainty of a tax. It is a good principle in taxation that those who are liable to pay a tax should be able, within reasonable bounds, to ascertain what the tax will mean, because in many cases, they make their future arrangements accordingly. Now, this Bill should be through this House in the course of the next couple of weeks—at least I am hoping it will—and once it becomes law, there will be no difficulty whatever, because the legislation will begin to operate at once, if any mining company is desirous of ascertaining what its taxation will be, in making their return and having the officials of the department check it over and make an assessment upon it. I think we should be able to begin making our assessment in May. Returns will be called for in May or June, or, if any are unduly apprehensive about the amount they will have to pay, they can easily ascertain substantially what it will amount to.

Mr. Turriff: The Minister of Finance has just spoken about the capitalization of mines. I am not sure that I clearly understood what he said. Suppose that a mining company, organized a few years ago, has a paid-up capital of \$250,000. They bought a property for \$100,000 and spent \$150,000 in plant and in carrying on the business. Between that time and the time when this tax comes into effect they make a fine discovery of ore, so that the mine, instead of being worth \$100,000, is worth \$1,000,000. In that case, is that \$1,000,000 capital, or is it not?

Sir Thomas White: Assuming that \$1,000,000 is a proper valuation in the opinion of experts, then I should say the true position of that company would be this: Its capital is \$250,000, and its reserve, rest, and accumulated profits make up the balance. Its capital, for the purposes of this Act, would be \$1,000,000.

Fraser & Chalmers of Canada, Limited, of Montreal, have recently been awarded the contract by the City of Regina, covering the delivery and erection of a 300 h.p. steam turbine direct connected to two centrifugal pumps having a total capacity of seven million Imperial gallons per twenty-four hours.

The directors of the Consolidated Mining and Smelting Co. of Canada, Ltd., with head office in Toronto, on March 10th declared a quarterly dividend at the rate of ten per cent. per annum, payable April 1st. The amount of this dividend will be \$145,125.

MINERAL PRODUCTION IN CANADA IN 1915

By John McLeish

(Continued from last issue)

Asbestos.

The asbestos production in 1915 was obtained from the same field in Quebec as heretofore. The output was less than in 1914, but sales showed an increase of about 17 per cent. Stocks on hand at the end of the year showed a noticeable decrease.

The total output in 1915 was 106,558 tons, as against 107,668 tons in 1914, showing a decrease of 1,110 tons or 1.03 per cent. The sales and shipments during 1915 were 113,115 tons valued at \$3,491,450, or an average of \$30.87 per ton, as against sales in 1914 of 96,542 tons valued at \$2,892,266 or an average of \$29.92 per ton. The 1915 sales were larger in quantity than those of 1914 by about 17 per cent. and in value by about 20 per cent.

Stocks on hand at December 31st, 1915, were 22,052 tons, as compared with stocks on hand of 31,171 at the end of the previous year.

The number of men employed in the mines or quarries and mills were 2,393 and the amount paid in wages was \$1,089,976 as against 2,992 men employed in 1914 to whom was paid in wages \$1,283,977.

The total quantity of asbestos rock milled during the year is reported as 1,795,472 tons, which with a mill production of 102,571 tons shows an average estimated content of about 5.71 per cent. of asbestos fibre in the rock. The estimated content of fibre in rock milled in 1914 was 6.03 per cent.

The output and sales of crude and mill stock are shown in the table following. The classification is based on valuation: Crude No. 1 comprising material valued at \$200 per ton and upwards, and Crude No. 2 material valued at less than \$200 per ton; Mill stock No. 1 including mill fibre valued at \$30 and upwards, Mill stock No. 2, mill fibre valued at \$15 to \$30 per ton,

1914 valued at \$2,298,646 or an average of \$28.35 per ton. There was also an export of asbestos sand amounting to 25,103 tons valued at \$157,410 or an average of \$6.27 per ton and of manufactures of asbestos valued at \$125,003.

Imports of asbestos manufactures for the year amounted to \$168,894.

Chromite.

From 1910 to 1914 inclusive no chromite was mined in Canada, and only a few small shipments were made from stock; but in 1915, according to returns received, shipments amounted to 11,486 tons, valued at \$162,618.

In the early summer the demand for chromite in the United States led to considerable activity in the chromite-producing area in the vicinity of Black Lake and Coleraine, Quebec. Old dumps were picked over, and old pits re-opened. During the summer months ore averaging probably less than 30 per cent. Cr_2O_3 found a ready market, but towards the close of the year buyers were insisting on a 35 per cent. ore.

The exports of chromite according to Customs records were 7,290 tons valued at \$81,838 or an average of \$11.23 per ton.

Coal and Coke.

Coal.—The total production of marketable coal for the year 1915, comprising sales and shipments, colliery consumption, and coal used in making coke, or used otherwise by colliery operators, was 13,209,371 short tons valued at \$31,957,757, as against 13,637,529 tons valued at \$33,471,801 in 1914 showing a decrease of 428,158 tons, or 3.14 per cent. in quantity, and of \$1,514,044 or 4.52 per cent. in total value.

In estimating the values of the coals arbitrary values are assumed for the Nova Scotia and British Columbia

Output Sales and Stocks of Asbestos in 1915.

	Output		Sales		Stock on hand Dec. 31		
	Tons	Tons	Value	Per ton	Tons	Value	Per ton
Crude No. 1.....	2,305.6	2,735.4	749,811	274.11	589.8	176,533	299.31
Crude No. 2.....	1,681.6	2,631.3	322,049	122.39	316.6	43,006	135.84
Mill stock, No. 1.....	21,710	24,238	1270,074	52.40	2,176	91,919	42.24
Mill stock, No. 2.....	41,973	42,031	840,132	19.99	12,837	268,197	20.89
Mill stock, No. 3.....	38,888	41,479	309,384	7.46	6,133	55,555	9.06
Asbestos.....	106558.2	113114.7	3491,450	30.87	22,052.4	635,210	28.80
Asbestic.....	25,700		21,819	0.85			

and Mill stock No. 3 mill fibre valued at less than \$15 per ton.

The total sales of crude asbestos in 1915 were 5,366.7 tons valued at \$1,071,860 or an average of \$199.72 per ton as against sales in 1914 of 4,147.9 tons valued at \$773,193 or an average of \$186.42 per ton.

The total sales of Mill stock in 1915 were 107,748 tons valued at \$2,419,590 or an average of \$22.46 per ton, as against sales in 1914 of 92,394 tons valued at \$2,119,073, or an average of \$21.64 per ton.

There was also a production of asbestic of 25,700 tons valued at \$21,819.

Exports of asbestos during the calendar year 1915 were 84,584 tons valued at \$2,734,695 or an average of \$32.45 per ton, as against exports of 81,081 tons in

production, viz.: \$2.50 per long ton for the former and \$3.50 per long ton for the latter. The values used for coal production in the other provinces are those furnished by the operators.

The Nova Scotia production was 7,429,888 tons, an increase of 58,964 tons, or 0.8 per cent. over that of 1914; the Alberta production 3,320,431 tons, a decrease of 362,584 tons or 9.8 per cent., the British Columbia production 2,089,966 tons, a decrease of 149,833 tons, or 6.7 per cent.; the Saskatchewan production 236,940 tons, an increase of 4,641 tons, or about 2 per cent.; the New Brunswick production 122,422 tons, an increase of 24,373 tons, or 24.85 per cent.; and Yukon Territory, a production of 9,724 tons, a decrease of 3,719, or 28 per cent.

Production of Coal by Provinces.

Province	1913		1914		1915	
	Tons	Value \$	Tons	Value \$	Tons	Value \$
Nova Scotia.....	7,980,073	17,812,663	7,370,924	16,452,955	7,429,888	16,584,573
British Columbia..	2,714,420	8,482,562	2,239,799	6,999,374	2,089,966	6,531,144
Alberta.....	4,014,755	10,418,941	3,683,015	9,350,392	3,320,431	8,136,527
Saskatchewan.....	212,897	358,192	232,299	374,245	236,940	361,787
New Brunswick...	70,311	166,637	998,049	241,075*	122,422	304,830
Yukon.....	19,722	95,945	13,443	53,760	9,724	38,896
Total.....	15,012,178	37,334,940	13,637,529	33,471,801	13,209,371	31,957,757

* Railway Shipments.

The exports of coal in 1915 were 1,766,543 tons valued at \$5,406,058 as compared with exports of 1,423,126 tons in 1914 valued at \$3,880,175, an increase of 343,417 tons or 2.41 per cent.

The imports of coal in 1915 were made up as follows: bituminous round and run of mine; 6,106,794 tons, valued at \$7,564,369, or an average of \$1.24 per ton, bituminous slack 2,286,916 tons valued at \$2,027,256, or an average of \$0.89 per ton, and anthracite 4,072,192 tons valued at \$18,753,980 or an average of \$4.61 per ton, making a total of 12,465,902 tons valued at \$28,345,605.

Imports during 1914 included bituminous, round and run of mine 7,776,415 tons valued at \$14,954,321 or an average of \$1.92 per ton, bituminous slack 2,509,632 tons valued at \$3,605,253 or an average of \$1.43 per ton, and anthracite 4,435,010 tons valued at \$21,241,924 or an average of \$4.79 per ton, making total imports of 14,721,057 tons valued at \$39,801,498.

The above figures show that in 1915 there was a decrease from imports of the previous year in quantity of 2,255,155 tons, or 15.3 per cent., and in value of \$11,455,893, or 28.78 per cent. The larger decrease in value is due to the average value of bituminous, round, and run of mine dropping from \$1.92 per ton in 1914 to \$1.24 per ton in 1915, and that of bituminous slack from \$1.44 to \$0.89.

The details of the decreases in imports are as follows: in bituminous, round and run of mine 1,669,621 tons or 21.5 per cent.; in bituminous slack of 222,716 tons, or 8.9 per cent.; and in anthracite of 362,818 tons or 8.2 per cent.

The apparent consumption of coal during 1915 was therefore 23,849,040 tons, as against a consumption the previous year of 26,852,323 tons. Canadian mines contributed 48 per cent. of the domestic consumption, and the balance was imported. The total Canadian production was equivalent to about 53.4 per cent. of the consumption.

Coke.—The total output of oven coke during 1915 was 1,200,766 short tons made from 1,856,393 tons of coal of which 1,425,172 tons were of domestic origin, and 431,221 tons were imported. The total quantity of coke sold, or used by the producers during the year was 1,168,921 tons valued at \$4,253,536 or an average of \$3.64 per ton.

In 1914 the total output was 1,015,253 tons, and the quantity sold, or used by the producers, was 1,023,860 tons valued at \$3,658,514 or an average of \$3.57 per ton.

Returns for 1915 show a production of 0.647 tons of coke per ton of coal charged, as compared with 0.658 tons of coke per ton of coal charged in 1914.

The output of coke by provinces in 1915 was as follows: Nova Scotia 584,993 tons, an increase of 239,113 tons over 1914 production; Ontario 316,211 tons, a decrease of 61,303 tons; Alberta 24,187 tons, a decrease of 4,354 tons; and British Columbia 275,375 tons, an increase of 12,057 tons. The Ontario production was

entirely from imported coal.

By-products from coke ovens which included 10,448 tons of ammonium sulphate, 7,365,931 gallons of tar, and 4,089,602 thousand cubic feet of gas, made in 1915 were in excess of the production in 1914; there was also for the first time a production of benzol and associated compounds. The production of trinitrotoluene near the close of the year was reported by Col. Carnegie of the Shell Committee, as 100,000 pounds per week.

The ovens operated during the year were those at Sydney, Sydney Mines, and Westville, Nova Scotia; Sault Ste. Marie, Ontario; Coleman, Alberta; and Fernie, Michel, and Union Bay (Comox), B.C. At the close of the year there were about 1,742 ovens in operation, as contrasted with only 797 in operation at the end of 1914. Over 800 ovens at Stellarton and Londonderry in Nova Scotia; Port Arthur, Ontario; Lille and Passburg, Alberta; Carbonado and Hosmer, B.C.; were idle throughout the year.

Imports of coke during 1915 amounted to 637,857 tons valued at \$1,608,464, and exports were 35,869 tons valued at \$160,053.

Feldspar.

The 1915 production of feldspar was 15,455 tons, valued at \$59,124 or an average of \$3.18 per ton as compared with a production in 1914 of 18,060 tons valued at \$70,824 or an average of \$3.92 per ton. The year's production is slightly less than the average of the preceding six years. As usual by far the greater proportion of the production came from Frontenac County, Ontario. It is of interest to note, however, that there has been a renewal of feldspar mining in Hull Township, Quebec.

Fluorspar.

Fluorspar is obtained at Madoc, Ontario. There have been no shipments for three years, but the operators report having contracted for delivery of 1,000 tons in 1916.

Imports of fluorspar are not shown separately in the Customs records; imports of hydro-fluo-silicic acid in 1915 were 1,117,874 pounds valued at \$36,085.

Graphite.

Shipments of milled and refined graphite amounted to 2,610 tons valued at \$121,023 or an average of \$46.37 per ton. This includes 76 tons from mills at Buckingham, Que. The major portion of the production came from Calabogie, Renfrew county, Ont., with a small tonnage from Mumfords, Hastings county. The production includes material varying in value from less than \$40 to over \$150 per ton. The 1914 production was 1,647 tons valued at \$107,203. Operators report a greatly increased demand with higher prices owing to the shortage in supplies in the United States from sources outside of America.

Exports of plumbago and of manufactures of plumbago were valued at \$96,325 according to Customs records.

Gypsum.

The production of gypsum of all grades in 1915 is reported as 470,335 tons valued at \$849,928. This is lower than for several years, previous production having been 516,880 tons in 1914; 636,370 tons in 1913; and 578,454 tons in 1912. The Ontario production was practically the same as in 1914, while New Brunswick production showed a slight increase. In both Manitoba and Nova Scotia 1915 production showed a conspicuous decrease from that of the previous year.

Gypsum sold in 1915 was classified as follows: lump 342,467 tons; crushed 48,735 tons; fine ground 6,455 tons; and calcined 72,678 tons. In 1914 the tonnages of the various grades were: lump 351,729 tons; crushed 49,441 tons; fine ground 6,097 tons; and calcined 109,613 tons.

Exports of crude gypsum were 292,234 tons valued at \$336,380 being the smallest reported since 1908. Exports of ground gypsum which were valued at less than \$10,000 yearly for many years rose to a value of \$35,490 in 1914 and to a value of \$80,933 in 1915.

Magnesite.

The production of magnesite in 1915, chiefly crude but including some calcined, was 14,779 tons valued at \$126,535 in contrast with a yearly average production from 1908 to 1914 inclusive of 621 1-2 tons. The increased production was due largely to the urgent demands of steel companies and manufacturers of refractory brick.

All the production came from Grenville Township, Argenteuil County, Quebec. From the Atlin district, in British Columbia, several hundred tons were shipped to Vancouver, but not marketed.

Manganese Ores.

In 1915 there was according to returns received to date, a production of 47 tons of manganese ore (90 per cent. MnO_2) valued at \$5,460 or an average of \$116.17 per ton, as compared with a production in 1914 of 28 tons, valued at \$1,120 or an average of \$40.00 per ton.

The records of the Customs Department show exports of manganese ores amounting to 255 tons, valued at \$6,855, which would seem to indicate shipments additional to those reported.

The property at New Ross, Nova Scotia, formerly operated by the Nova Scotia Manganese Company, was taken over in September and reopened by the Metals Development Company of Halifax.

Natural Gas.

Complete returns have not yet been received from some of the largest operators in Ontario. The 1915 production of natural gas therefore (subject to the corrections of the estimates used) was approximately 18,319,710 thousand cubic feet valued at \$3,300,825 contributed by provinces as follows: Ontario 13,510,071 thousand cubic feet valued at \$2,202,523; New Brunswick 430,692 thousand cubic feet valued at \$60,383, and Alberta 4,378,947 thousand cubic feet valued at \$1,037,919.

The production the previous year was reported as 21,692,504 thousand cubic feet valued at \$3,484,727 of which amount Ontario produced 14,094,521 thousand cubic feet valued at \$2,215,808; New Brunswick 425,826 thousand cubic feet valued at \$54,249, and Alberta 7,172,157 thousand cubic feet valued at \$1,214,670.

Ontario's production in 1915 showed a decrease of 584,450 thousand cubic feet. Alberta production a de-

crease of 2,793,210 thousand cubic feet, and New Brunswick production an increase of 4,866 thousand cubic feet.

The Ontario gas production came from the same fields in the southern portion of the province between Niagara Falls and Windsor, as heretofore. In 1914 and 1915 gas from the Kent fields was distributed as far east as Hamilton, a distance of 153 miles.

The New Brunswick production is obtained in Albert County and supplies chiefly Hillsborough and Moncton, while in Alberta, Medicine Hat and Bow Island are still the principal gas fields, being utilized, supplying the district between Medicine Hat and Calgary.

Petroleum.

The annual production of crude petroleum which had been showing a steady decrease from 1907 to 1914 showed in 1915 a slight increase in quantity over the 1914 production. The value, though, was the lowest recorded in the records of the Division which date back to 1885 for the average price per barrel in Western Ontario (from which nearly the entire Canadian production comes) was the lowest in several years.

A bounty of 1½ cent per gallon is paid on the marketed production of crude oil from Canadian oil-fields through the Department of Trade and Commerce. From the bounty statistics it appears that the 1915 production in Ontario and New Brunswick was 215,464 barrels on which bounties amounting to \$113,118.45 were paid. The market value of this crude oil at \$1.39½ per barrel amounted to \$300,572. In Alberta there was a small production of crude oil, but no bounty was paid on this as the specific gravity was below the standard set by the Petroleum Bounty Act, and complete records have not been furnished by the producers.

The total production of crude oil (exclusive of Alberta) in 1915 is therefore, 215,464 barrels, valued at \$300,572 as compared with a production in 1914 of 214,805 barrels valued at \$343,124.

The average monthly price of crude oil per barrel at Petrolia for the year was \$1.39½ as compared with \$1.59 in 1914, and \$1.782 in 1913. For the first seven months of the year the average price was almost constant at \$1.30½ per barrel, but during the last five months it showed an increase month by month reaching a maximum of \$1.70 in December.

The Ontario production in 1915 was, according to the records of the Department of Trade and Commerce at Ottawa, 214,444 barrels. The production in barrels of the various fields, as furnished by the Supervisor of Petroleum Bounties at Petrolia, was as follows: Lambton, 161,368; Tilbury, 12,742; Bothwell, 33,395; Dutton, 5,401; Onondaga, 1,490, and Belle River 46; giving a total of 214,442 barrels. In 1914 the production by fields was as follows: Lambton, 154,186; Tilbury, 18,530; Bothwell, 33,961; Dutton, 2,190; Onondaga, 2,437; and Belle River, 1,191; giving a total of 212,495 barrels.

The production in New Brunswick was 1,020 barrels as against 1,725 in 1914 and 2,111 in 1913.

Exports of petroleum entered as crude mineral oil in 1915 were 35,977 gals., valued at \$1,789, and of refined oil 103,488 gals., valued at \$14,107. There was also an export of naphtha and gasoline of 16,644 gals., valued at \$4,540.

The total value of the imports of petroleum and petroleum products in 1915 was \$8,047,781 as against a value of \$11,174,763 in 1914.

The total imports of petroleum oils, crude and refined, in 1915 were 236,923,765 gals., valued at \$7,979,-

264. The oil imports included, crude oil 192,588,487 gals. valued at \$3,678,021; refined and illuminating oils, 6,792,873 gals. valued at \$405,019; gasoline 28,030,972 gals. valued at \$2,693,717; lubricating oils 4,557,179 gals. valued at \$755,535; and other oils, products of petroleum, 4,954,254 gals. valued at \$446,972. The oil imports in 1914 were: crude oil, 195,207,210 gals. valued at \$5,750,971; refined and illuminating oils 12,833,065 gals. valued at \$970,481; gasoline 24,396,401 gals. valued at \$2,747,360; lubricating oils 5,767,676 gals. valued at \$940,143 and other oils, products of petroleum, 6,283,621 gals. valued at \$663,407, making a total of 244,487,973 gals. valued at \$11,072,362.

The imports of petroleum products in 1915 included 980,662 pounds of paraffin and paraffin wax candles valued at \$68,517, as compared with imports in 1914 of 1,594,236 pounds valued at \$102,401.

Pyrites.

The production of pyrites in 1915 was 296,910 tons valued at \$1,028,678, of which 153,607 tons valued at \$614,428 was mined in Quebec, and 143,303 tons valued at \$414,250 was mined in Ontario. The 1914 production was 228,314 tons valued at \$744,508 of which 117,698 tons valued at \$470,792 came from Quebec and 110,616 tons valued at \$273,716 came from Ontario.

Exports of pyrites in 1915 were 137,598 tons valued at \$527,318, or an average of \$3.83 per ton, as compared with exports in 1914 of 89,888 tons valued at \$377,985, or an average of \$4.21 per ton.

Exports of sulphuric acid in 1915 amounted to 19,270,572 pounds valued at \$243,457, as against exports in 1914 of 7,485,509 pounds valued at \$45,612.

Salt.

The total sales of salt in 1915 were 119,900 tons, valued at \$600,226 (exclusive of the cost of packages) as compared with sales in 1914 of 107,038 tons, valued at \$493,648. The entire Canadian production of recent years has come from Southwestern Ontario.

The Canadian Salt Co. in addition to selling salt, uses a portion of its production in its chemical works at Sandwich, Ontario, where caustic soda and bleaching powder are manufactured.

The exports of salt were 889,300 pounds, valued at \$5,836, as compared with exports in 1914 of 952,700 pounds valued at \$5,229.

The total imports of salt in 1914 were 137,486 tons valued at \$517,526 and included 27,613 tons of fine salt in bulk, valued at \$84,449; 6,867 tons of salt in packages, valued at \$50,997, and 103,006 tons of salt imported for the use of fisheries, valued at \$382,080. The imports in 1914 were 142,646 tons, valued at \$540,881, including 26,065 tons of fine salt in bulk valued at \$82,149; 7,828 tons of salt in packages, valued at \$68,959; and 108,753 tons of salt for the use of sea or gulf fisheries, valued at \$389,773.

Talc.

The production of talc was about the same as in the two preceding years, the 1915 shipments being 11,885 tons, valued at \$40,554.

The output of talc, all of which comes from the vicinity of Madoc, Ontario, is marketed in both crude and ground form in the United States and Canada.

Cement.

The general decrease in production of structural materials and clay products which was a feature in 1914 was repeated in 1915, the production in the latter year

being valued at \$18,712,074, as against a production in 1914 valued at \$26,009,227.

The total quantity of Portland cement, including natural Portland, made in 1915 was 5,153,763 barrels of 350 pounds each, as compared with 8,727,269 barrels in 1914, a decrease of 3,563,506 barrels, or about 40 per cent.

The total quantity of Canadian Portland cement sold or used during 1915 was 5,681,032 barrels, valued at \$6,977,024 or an average of \$1.228 per barrel, as compared with 7,172,480 barrels, sold or used in 1914, valued at \$9,187,924, or an average of \$1.28, showing a decrease in quantity of 1,491,448 barrels, or about 20 per cent.

The total imports of cement in 1915 were 98,664 ewt. equivalent to 28,190 barrels of 350 pounds each, valued at \$40,426, or an average of \$1.434 per barrel, as compared with imports of 98,022 barrels, valued at \$147,158, or an average of \$1.50 per barrel in 1914.

The total consumption of cement, therefore, neglecting a small export, was 5,709,222 barrels, as compared with a consumption of 7,270,502 barrels in 1914, showing a decrease of \$1,561,280 barrels, or about 21 per cent.

The average price per barrel at the works in 1915 was \$1.228 as compared with \$1.28 in 1914, \$1.27 in 1913, \$1.28 in 1912, and \$1.34 during 1911 and 1910.

The imports of cement in 1915 included 1,065 barrels, valued at \$1,480, from Great Britain, and 27,125 barrels, valued at \$38,946, from the United States.

Production and Sales of Portland Cement.

	1914.	1915.
	Brls.	Brls.
Portland cement sold or used.....	7,172,480	5,681,032
Portland cement manufactured.....	8,727,269	5,153,763
Stock on hand Jan. 1st.....	1,073,328	2,602,022
Stock on hand Dec. 31st.....	2,628,117	2,062,961
Value of cement sold or used.....	\$9,187,924	\$6,977,024
Wages paid.....	2,271,006	1,180,882
Men employed.....	2,977	1,679

Exports of Products of the Mine and Manufactures of Mine Products, Calendar Year 1915.

(Compiled from Trade and Navigation Statements).

Products	Quantity	Value
Arsenic, cwt.....	46,364	\$ 174,190
Asbestos, tons.....	84,584	2,734,695
Asbestos sand, tons.....	25,103	157,410
Coal, tons.....	1,766,543	5,406,058
Chromite, tons.....	7,290	81,838
Feldspar, Magnesite, Talc, etc.....		148,915
Gold.....		16,528,143
Gypsum, crude, tons.....	292,234	336,380
Copper, fine, in ore, etc, lb.....	81,437,063	8,671,641
Copper, black, or coarse, and in pigs, lb.....	21,292,516	3,788,715
Lead, in ore, etc, lb.....	1,845,100	40,273
Lead, pig, etc, lb.....	2,066,929	79,067
Nickel, in ore, etc, lb.....	66,410,442	7,394,446
Platinum, oz.....	236	11,052
Silver, oz.....	27,672,481	13,812,018
Mica, lb.....	879,631	236,124
Mineral Pigments, cwt.....	23,916	17,263
Mineral water, gal.....	198	53
Oil, mineral, crude, gal.....	35,977	1,789
Oil, mineral, refined, gal.....	103,488	14,107
Ores:—		
Antimony, tons.....	1,149	82,990
Corundum, tons.....	339	37,798
Iron, tons.....	79,770	206,823
Manganese, tons.....	255	6,855
Other ores, tons.....	23,816	798,214

Phosphate, tons.....	179	1,860
Plumbago, crude ore, etc., cwt.....	5,254	12,009
Pyrates, tons.....	137,598	527,318
Salt, cwt.....	8,893	5,836
Sand and Gravel, tons.....	808,022	380,549
Stone, ornamental, tons.....	29,976	12,764
Stone, building, tons.....	35,804	28,910
Stone, crushed, tons.....	42,716	24,453
Stone, for manufacture of grindstones, tons.....	180	900
Other products of the mine, tons.....		53,106

Total mine products..... 61,814,582

MANUFACTURES.

Agricultural implements:—		
Mowing machines, No.....	5,031	175,912
Cultivators, No.....	5,957	166,602
Reapers, No.....	471	21,105
Drills, No.....	6,400	422,772
Harvesters and Binders, No.....	7,668	809,141
Ploughs, No.....	14,923	309,286
Harrows, No.....	4,459	81,731
Hay Rakes, No.....	1,758	40,289
Seeders, No.....	2	87
Threshing machines, No.....	1,001	568,401
All other.....		302,355
Parts of.....		519,379
Asbestos, manufactures of.....		
Bricks, M.....	1,155	9,089
Cement.....		5,161
Clay, manufactures of.....		25,202
Coke, tons.....	35,869	160,053
Drugs:—		
Acetate of lime, lb.....	10,001,830	205,748
Acid sulphuric, lb.....	19,270,572	243,457
Calcium carbide, lb.....	102,017,471	3,160,950
Phosphorus, lb.....	545,050	77,476
Earthenware and all manufactures of.....		
Fertilizers.....		2,335,297
Grindstones, manufactured.....		35,334
Gypsum or Plaster, ground.....		80,933
Iron and Steel, and manufactures of:—		
Stoves, No.....	1,271	18,563
Gas buoys and parts of.....		2,017
Castings, N.O.P.....		143,714
Pig iron, tons.....	17,307	231,551
Ferro-silicon and ferro-compounds, tons.....	9,238	537,081
Wire and wire nails, cwt.....	1,439,950	3,224,740
Machinery:—		
Linotype machines and parts of.....		6,946
Sewing machines, No.....	2,557	30,479
Washing machines, No.....		20,334
Typewriters, No.....	3,175	206,811
Machinery, N.O.P.....		536,162
Scrap iron and steel, cwt.....	1,787,155	883,134
Hardware, viz.: tools, hand or machine.....		321,021
Hardware, N.O.P.....		401,053
All other, N.O.P.....		31,147,770
Lime.....		15,617
Metals:—		
Aluminum in bars, etc., cwt.....	186,808	3,333,726
Aluminum manufactures of.....		620,562
Brass, old and scrap, cwt.....	120,685	1,468,165
Copper, old and scrap, cwt.....	41,616	616,553
Metallic shingles etc.....		66,655
Metals, N.O.P.....		878,258
Mineral and aerated waters (in bottles).....		
Oil, gasoline and naphtha, gal.....	16,644	4,540
Oil, N.O.P., gal.....	1,247,376	290,943
Plumbago, manufactures of.....		84,316
Stone, ornamental.....		5,990
Stone, building.....		660
Tar.....		37,331
Tin, manufactures of.....		173,206
Vehicles:—		
Automobiles, No.....	13,475	6,756,395
Automobiles, parts of.....		363,178
Bicycles, No.....	116	4,692
Bicycles, parts of.....		15,547
		62,343,279
Grand Total.....		124,157,861

"SULPHUR SMOKE" CASES AT SUDBURY.

Sudbury, March 22.—In a special sitting of the Supreme Court, before Hon. Mr. Justice Middleton, the hearing of the "sulphur smoke cases" which have been entered against the two nickel smelting companies in this district, was commenced at Sudbury on Monday. Four cases are being heard against the Canadian Copper Company and two against the Mond Nickel Co. Damages are sought for loss of crops, stock, buildings, machinery, fences, pollution of water supply and injury to lands, as the case may be, from the sulphur smoke and gases alleged to have been emitted by the companies from their smelters, roast yards and other works during the past year. In each case an injunction is sought to restrain the defendant companies from further injury or damage to the plaintiffs.

The court room has been crowded to overflowing at every session, largely by the farming section of the community, and great interest is being evidenced in the progress of the cases.

Probably no session of the Supreme Court in the North Country has seen so many eminent members of the legal profession arrayed on both sides as are engaged in the conduct of the cases. Conducting the defence of the Canadian Copper Co. are D. L. McCarthy, K.C., and Britton Osler, of McCarthy, Osler, Hoskin and Harecourt (Toronto), and G. E. Buchanan (Sudbury). For the Mond Nickel Co., Ltd., are J. M. Clark, K.C., and R. U. Macpherson, of Macpherson, Clark, Campbell and Jarvis (Toronto). Mr. Hartley Dewart, K.C. (Toronto), appears as general counsel for all the plaintiffs, and has associated with him A. W. Fraser, K.C. (Ottawa) and J. A. Mulligan, J. H. Clary and J. S. McKessock (Sudbury).

At the opening of the session it was agreed between counsel and concurred in by the Court to permit evidence of a general nature from the various witnesses to be called as to alleged damages and injury of sulphur smoke on vegetation, etc., in addition to the actual knowledge of the damage alleged by the claimants. While nominally proceeding with the case of the Sudbury & Copper Cliff Dairy, witnesses were interrogated as to their general knowledge of alleged injury and damage from sulphur smoke and gases, as they were called. This roving commission, so to speak, extended to McKim, Garson, Rayside, Blezard and Broder townships in the evidence so far presented.

With the exception of the case of Belanger vs. the Canadian Copper Company, all the cases are independent actions. The Belanger case, it is understood, is in the nature of a test case, there being a large number of claimants for alleged damages awaiting the result of the action before proceeding in their case, the nature of their claims being identical to those in the Belanger case.

A great number of witnesses are in attendance, including some fifteen experts to deal with all phases of the sulphur smoke question, while possibly one hundred other witnesses will be called upon to testify.

NIPISSING.

Nipissing Mines Company reports cash in bank on March 20, \$898,527; bullion in transit, \$311,977; ore on hand and in process, and bullion ready for shipment, \$553,597; total, \$1,764,101. The company declared a dividend of 5 per cent., payable April 20 to stock of record March 31.

FLOTATION PROCESSES*

By C. Terry Durell.

(Continued from p. 123, March 1.)

Essential Elements.

Cold solutions were seen to be used with some processes. Therefore heat is not an essential element to flotation. Vacuum is used in the one type to produce the gas so it is not essential to flotation. Oil is not always used in froth flotation so it is not an essential element to any except bulk oil flotation. This fact is also shown by the new process of Louis A. Wood. An alkali is used in one case to neutralize the excess acid and in others in place of an acid. Either an acid or an alkaline solution will do and, from the amounts used in mill solutions, it is seen that extremely dilute solutions are effective. That is, complete ionization exists and the effect is that of an electrolyte. By this process of elimination there are left the essential elements as follows: air for surface tension flotation; oil for bulk oil flotation; and gas and an electrolyte for froth flotation.

It is seen that the gas, to form bubbles in froth flotation, can be generated chemically or electrolytically within the pulp mass or it can be (1) beaten in with stirrers, (2) forced in by pressure (that of the atmosphere or greater), or (3) carried in by jets.

Attachment of Mineral Particles to Bubbles.

Something more than mere bubbles of gas within the pulp mass is necessary to make froth flotation effective. The mineral particles must either be attached to the bubbles or the bubbles must be attached to the mineral particles.

Since a bubble carries with it a surface film of liquid the mineral particle must be caught by this surface film in froth flotation or caught by the free surface of the liquid in surface tension flotation. The necessary conclusion then is that some inherent property of the mineral particle itself is the cause of its resting on the surface of the liquid in the one case or on the surface of the bubble in the other. If it were possible to attach a mineral particle to a bubble already formed by some physical, chemical or electrical force, then it might be possible that surface tension flotation and froth flotation are in no way related, and that bubble attachment is in no way dependent upon some property of the particle itself. It is a well known fact, however, that no such attachment can take place to bubbles that are already formed.

A stream of compressed air turned into a pulp mass in a perfect float condition can not effect flotation, as is well known by every one who has tried it. The bubbles not only rebound from one another but the mineral particles show no tendency to adhere and the bubbles come to the surface without the mineral particles. This is due to the surface film, which phenomena will be taken up later, when it will be shown that there can be no adhesion between this liquid film and the mineral particle, be it either wetted with oil or water. There is no reason for any chemical affinity.

In an electrical field, it is possible for bubbles to be electro-negatively or electro-positively charged. There is no reason why these charges might not be reversed at will by varying the field. Also it is a well known fact that mineral particles can be electrically charged and this is taken advantage of in electrostatic concentration. Cottrell dust precipitation, clay separation, etc. It is also shown in colloidal work that, under the same

condition, some minerals are negatively charged, while others have an opposite charge. It is upon these facts that electrical theories of flotation are based. Assume that the particles of metals, sulphides, tellurides, arsenides and the like "have charges of one polarity (positive), and that non-floatable particles have charges of the opposite polarity (negative)," and also that the bubbles are negatively charged. Witness then the metallic particles jumping for and clinging to the bubbles. A beautiful theory if it were true and would explain all connected with flotation.

In the first place, flotation is not dependent upon an electrical field as is electrostatic concentration, dust precipitation, Boethe Schwerin's Electro-Osmotic Process, and others. It would also be possible to attach mineral particles to bubbles already formed by the assumption of an electrical theory. So far, these electrical theories have considered oil as an essential element to flotation, which, as shown above, is not the fact. If a slight change in the strength of the electrolyte will change the polarity of quartz, calcite and the like so as to cause them to sink, when before they were floating, why will it not also change the polarity of some metallic particles so as to create a preferential flotation? No. It is far better to make a theory conformable to the facts than to try to ignore and twist facts to conform to some of the present electrical theories. Since there is no known way to attach mineral particles to bubbles already formed, bubble attachment depends directly upon some property of the particle itself. This property must then be the same for particles floating in either a surface tension or a frothing machine. As shown by Mickle's experiments, this must be due to gas occlusion.

Why is it then that no solid can be floated unless it contains occluded gas? A particle once wetted with the flotation liquid tends to sink as there is no surface tension effect tending to float it. Water is always used as the flotation liquid as it is the cheapest and has the greatest surface tension of all liquids except mercury. If all gases be driven from a solid, water will enter the pores and adhere to its surface. No surface tension effect can be then exhibited towards it for the reason that it is then as part of the water. Thus a force of adhesion predominating, flotation can not take place. This truth is not so readily seen when the particle is below the surface of the water and an attempt is made to float it by means of a bubble. The surface tension of the liquid film surrounding a gas bubble is much greater than the adhesive force of the gas for a solid. The gas is, in this way, firmly held within the enclosing liquid film and attachment between it and a solid cannot take place. As has been shown above, **it is only the gas that is formed within the pulp mass that is of any value in flotation.** In other words, this nascent gas is attracted by the gas at the surface of the solid. A cohesive force exists between the molecules of the gas at the surface of the solid and those in the immediately surrounding liquid so that the solid becomes a nucleus for the formation of a bubble from the nascent gas of the liquid.

As shown above, there are three mechanical ways of forcing air or a gas into solution. There are three methods of expelling it: (1) supersaturation so that the

*Extract from an article published in the Colorado School of Mines Magazine, Feb., 1916.

excess gas is driven out; (2) heating to increase the volume and drive some out; and (3) reduction of pressure.

The same cause that tends to supersaturate a liquid with gas, will evidently tend to supersaturate a solid with this same gas if this solid be within the liquid. The dissolved gas will evidently be expelled from both the liquid and a solid within it by the same force—one of the above. Due to adhesion, the gas, as it is expelled, tends to condense on the solid or increase the amount of adsorbed gas. Lest confusion arise, it may be stated that adsorb is here used in the sense of being one of the three ways that solids hold gases. With sufficient condensation, a bubble will form on the surface of the solid from these molecules as they collect.

As a logical sequence from the above reasoning, **solids with high occlusive power for gases should have a greater tendency to float.** Hezekiah Bradford was the first to recognize this fact.³ "The floating particles appear to possess some peculiar qualities which repel water from their surfaces, especially when the particles are exposed, even momentarily, to atmospheric air." It is only necessary to look into the subject of ore deposition to learn the reason why metallic particles occlude gas more readily than other minerals. Chemical affinity assists in this occlusion of air and carbon dioxide, which eventually change the sulphides and like ores into sulphates, carbonates, oxides, etc. This greater power of occlusion is a cause of selective flotation.

Selective flotation is here used as a general term in contradistinction to preferential flotation, an accepted term to designate the separation of minerals that ordinarily float together. Horwood accomplishes this by a roast that oxidizes some sulphides and not others. The same effect is accomplished by others by coating the sulphides not desired in the concentrate. Leslie Bradford uses a reducing gas to accomplish this result.

By the aid of the microscope, Hebron, an associate of Carrie J. Everson, discovered that the desirable minerals, to be saved by concentration, have larger pores and surfaces than equal sized gangue particles. This gives greater chance for gas occlusion. Oil and like substances are usually but slightly soluble in water. The reverse is also true.

There is little adhesion between water and a surface wetted with oil, or oil and a surface wetted with water. Oil, due to its property of capillary attraction can readily enter the pores of solids not filled with water. Therefore, most metals, sulphides and the like containing occluded air are capable of absorbing more oil due to their larger pores and surfaces. With sufficient oil thus attached, agglomeration or bulk oil flotation takes place.

By this process of elimination, the same conclusion is reached as that demonstrated by Mickle's experiments. **Gas is the necessary substance** for Surface Tension, Bulk Oil and Froth Flotation methods and this must be occluded gas. Nascent gas and an electrolyte are also essential elements for Froth Flotation.

What is the function of the electrolyte? As has been shown, an acid or an alkali creates the selective action in froth flotation. How? By its ability to vary the contact angle between the surface of the mineral particle and the liquid film on either a bubble of measurable radius or a horizontal liquid surface of infinite

radius. Dr. Young showed the constancy of contact angles. H. Livingston Sulman, investigating figures for contact angles found "discrepant readings" due to "existence of a variable range of the contact angle." C. G. Lamb termed this angular difference "the angle of hysteresis." Speaking of this, Mr. Sulman says:⁴ "Whereas the angular hysteresis of silica in plain water may exceed 30 degrees, thus indicating the substance to have a definite power to occlude gas and to float, it drops from 4 degrees to nil in water acidulated with sulphuric acid."

The occluded gas can be driven out from a solid in the same way that it can be driven from a liquid. This gas of the solid particles will cause them to become nuclei for the formation of bubbles from the gas "coming into being" from the liquid and, as the bubbles grow, the particles are lifted or floated. Since there is more occluded gas in the metallic particles, all that is necessary to create the selective action of flotation is to drive out a considerable portion of the occluded gas from all particles. There then will be insufficient gas remaining with the gangue particles to cause them to act as nuclei upon which to grow bubbles. The metallic particles still having occluded gas are then floated while the gangue particles sink.

As shown above, this selective effect is produced in extremely dilute solutions. An electrolyte produces it, but how? It was also shown that some force is required to expel occluded gas. No outside force such as pressure or heat is the cause. Therefore it is an internal one that drives this occluded gas from the mineral particles. The ions of the electrolyte displace the equilibrium and the force that causes the gas occlusion is, at least partially, neutralized so that the tendency of the gas is then to diffuse throughout the liquid instead of remaining in the solid.

A parallel case in physics is osmosis. **The function of the electrolyte, therefore, is to create osmotic pressure.** The septum is the surface of the mineral particle. Ions of the electrolyte enter the solid while those of the gas leave. This action continues to the eutectic point and bubbles form on the metallic particles, as described above. Greater delicacy of manipulation is obtained with an alkali. Further advancement along this line means that selective action can be created between sulphates, carbonates, etc., and gangue minerals. Also that, by means of a variation of the electrolyte, preferential flotation can be effected and different metals can be separated.

Increased strength of the electrolyte will sometimes "kill" the float; or, in other words, increased osmotic pressure drives the air from the metallic particles, leaving them in the same condition as those of the gangue. This effect is not to be confused with an entirely different phenomenon which produces the same effect. Colloidal impurities like tannin, saponin, etc., or volatile oils and the like destroy bubbles by reducing the surface tension to the extent that the gas pressure from within bursts them. This weakening of the surface tension by a colloid is thus seen to be entirely different from the strengthening of osmotic pressure by a crystalloid, although the result is practically the same—no froth.

In studying this selective action, it is difficult to explain the motive power of osmosis, as present authorities do not agree. According to the Van't Hoff school it is the kinetic energy of the dissolved molecules obey-

³U. S. Pat. No. 345,951. 1885.

⁴Presidential address of H. Livingston Sulman. Institution of Mining and Metallurgy Transactions, 1912.

ing the laws governing gas pressure. It is the impact of these molecules against the walls of the semipermeable membrane. On the other hand, Kahlenberg shows it to be the force of chemical affinity, while Professor Traube proves it is an "interfacial pressure obtained by subtracting the surface tension of one fluid from the tension of the fluid into which it diffuses." Since surface tension is a cohesive force, osmosis may depend upon electromotive force because, according to both Sir Oliver Lodge⁵ and Fernando Sanford,⁶ the forces of chemical affinity and cohesion are electrical. This is a much mooted question for, by assuming Dr. Lupke's⁷ "Osmotic Theory of the Current of Galvanic Cells," the starting point is again reached. Fortunately the question as to the motive power of osmosis has no bearing on the result of the selective action in flotation caused by osmosis. As shown, this selective action in all three methods of flotation depends primarily upon gas occlusion by the mineral to be floated. Mickle showed that no mineral will float on the surface of hot acid solution, even if dilute. Thus an electrolyte creates a greater selective action in surface tension flotation.

This selective tendency exists in neutral solutions due to the fact that metallic particles occlude more gas than others. In bulk oil flotation, the metallic particles have occluded more air and, hence, are more easily wetted with oil than with water. The osmotic force set up by the electrolyte in froth flotation expels occluded gas from the mineral particles. There is still left with the metallic particles sufficient gas for them to act as nuclei so that the nascent gas of the liquid may form bubbles to float them.

Just as vapor must have a nucleus upon which to form a rain drop, so the nascent gas in flotation pulp must have a nucleus upon which to form a bubble. Duhem⁸ shows that a bubble will never form where the liquid is continuous, due to the fact that its infinitely small radius would be less than the limiting radius of collapsibility. Note how the vapor bubbles of boiling water form on the bottom or sides of the vessel.

Not only are bubbles necessary for froth, but they must be more or less persistent. The surface film that encloses the bubble as it is formed in the interior of the liquid becomes a part of that bubble and, due to surface tension, remains with it throughout its passage to the surface of the liquid, in the same way that the surface film of a soap bubble remains with it throughout its passage in the air. This is easily proved by slowly blowing a colored bubble at the bottom of a large beaker of which the upper portion at least is filled with clear liquid. Due to this fact, the bubbles may have their films strengthened or toughened so they will endure for a longer time. Therefore, if the bubble be coated with some such substance as oil, the total force of surface tension is increased, due to the surface tension of the water film plus that of the oil film. Surface tension tends to decrease the size of the bubble as is well illustrated by Boys,⁹ while the expansive force of the gas enclosed tends to enlarge it. The hydrostatic head aids surface tension in maintaining the bubble in the interior of the liquid.

Arriving at the surface, the bubble may burst due to: (1) interior gas expansion; (2) adhesive force of

the contained gas for the atmosphere; (3) evaporation of the enclosing film. Therefore an immiscible substance aids in two ways in making the bubble more persistent: (1) adding to the force of surface tension; (2) forming a film less easily evaporated. Since molecular forces are dealt with, these films approach one molecule in thickness and hence little oil is required. The colors of the bubbles also show this.

In addition to the oil film, the bubbles may be still further strengthened by an armor of metallic particles. These metallic particles containing occluded gas are, as shown above, more easily oil-coated than gangue particles. Due to cohesion, an electrical force, these particles are firmly held together and to the bubble film, which is then enclosed in a network of them just as a balloon is enclosed in a netting of rope. Bubbles thus made will endure for days and have been spoken of as "oil froth."

Oils that are good "collectors" are practically insoluble in water and form a film not easily evaporated, so make persistent bubbles. Good "frothers" are oils more or less soluble and, while they make quantities of bubbles and much froth, evaporate quickly, so that the bubbles burst more readily. Mineral particles are very easily coated with volatile oils and the bubbles are readily armored, but they burst readily, sometimes with violence. Being soluble, these oils decrease the surface tension since their surface tension is less than that of water.

Most oils aid flotation in three ways: by (1) increasing surface tension of the oil film with the additional force of surface tension of the water film; (2) decreasing adhesive force of the water for metallic particles by forming films around them; and (3) increasing cohesive force of metallic particles for each other by means of the oil film. Thus it is seen that although oil is a great aid, there can be no universal theory for flotation which considers oil necessary. By this method of elimination, it is shown that all processes and kinds of flotation can be satisfactorily explained by gas occlusion and that the bubbles for froth formation are from nascent gas.

BETHLEHEM STEEL CO.

Bethlehem Steel Corporation has issued its full pamphlet report for the year 1915. It shows that on December 31, 1915, cash on hand totaled \$15,380,350, against \$5,220,910 on December 31, 1914. Miscellaneous investments aggregate \$27,617,495, against \$437,664 on corresponding date of preceding year. Cash on hand and investments totaled \$42,997,845. A large percentage of these investments consist of Anglo-French bonds which Bethlehem Steel subscribed for last year.

The statement shows total provision for repairs and depreciation of \$9,106,671 last year, compared with \$4,716,273 in preceding year. Bonded debt of Bethlehem Steel Corporation on December 31, 1915, stood at \$31,099,000, a reduction of \$5,108,700 from December 31, 1914. There was appropriated for and invested in additions to property and working capital \$12,500,000. Actual amount of bonds purchased for sinking fund or cancelled was \$6,193,300.

⁵Electrons by Sir Oliver Lodge, Principal the University of Birmingham; Chap. 16, Nature of Cohesion, Page 153, July, 1906.

⁶A Physical Theory of Electrofication (1911), by Fernando Sanford, Prof. of Physics, Stanford University. Page 43.

⁷Elements of Electro Chemistry, by Dr. Robert Lupke. Part 3.

⁸Thermodynamics and Chemistry, by P. Duhem, 1903. Page 366

⁹Soap Bubbles, by C. V. Boys.

LE ROI NO. 2, LIMITED

The report of the directors of Le Roi No. 2, Ltd., for the company's fiscal year ended September 30, 1915, prepared for submission to the annual meeting of shareholders called for March 1, in London, England, is as follows:

"Accounts.—The accounts show a balance of £12,471 4s. 11d. in favor of Profit and Loss, after writing off £10,717 10s. 6d. as depreciation in respect of development, machinery, buildings, etc., which added to the balance brought forward from 1914, namely, £34,715 18s. 10d., makes a total of £47,187 3s. 9d. From this amount must be deducted the dividend of one shilling per share paid May 1, 1915, absorbing the sum of £6,000, and leaving a balance of £41,187 3s. 9d. to be carried forward.

"Production.—The Mine Managers' report shows that 24,289 tons of ore was mined, of which 15,681 tons was shipped to the smeltery, the average value per ton having been \$20.02 as against 17,014 tons of an average value of \$20.19 shipped during the previous year. There was produced 828 tons of concentrate, averaging \$17.48 per ton, from 9,467 tons of low-grade ore. Mining costs worked out at \$3.65 per ton, and smelting charges at \$6.46 per ton, making a total, after allowing for development and depreciation, of \$12.22 per ton, as against \$13.05 per ton for 1914.

"General.—The chief point of interest during the past twelve months has continued to be the deep-level exploration in the South Rodney vein. The results obtained here have been on the whole quite up to expectation. Difficulties at one time arose as to the simultaneous development of the vein and the extraction of ore, but these difficulties have now been overcome, and it is hoped that in the near future this part of the mine will contribute materially to the company's profits.

"During the year under review a dividend of one shilling a share was paid, and since the closing of the accounts a further interim dividend of one shilling a share has been paid in respect of the fiscal year 1915-1916.

"The company's interest in the Cloncurry Syndicate is now secured by the allotment of 13,380 shares in the Dobbin and Cloncurry Mines, Limited, which shares it is expected will prove to be of actual value to the company."

Mine Managers' Report.

The report of the mine managers, Messrs. Alexander Hill and Stewart, gave particulars of work done at different levels on various veins in the Josie group of mines, and on the adjoining Giant-California property held under option of purchase.

A summary of the development work on the Josie group shows a total of 1,293.5 ft. of driving, crosscutting, and raising, at a cost of \$23,642.78, equivalent to an average of \$18.28 per ft., and on the Giant-California of 895 ft. of driving and crosscutting (machine work) at a cost of \$15,819.61, or an average of \$17.67 per ft., and of 53.5 ft. of hand-driving at \$22.35 a foot.

Diamond drilling totalled 3,825.5 ft., of this 2,132 ft. was in the Josie and 667.5 ft. in the No. 1 mine, together 2,799.5 ft., at a cost in labor and material of \$5,021.06, or \$1.79 per ft., and 1,026 ft. was in the Giant-California, at a cost of \$1,926.36, or \$1.88 a foot.

The managers report, further: "We have taken advantage of the ruling high prices of copper to give every preference to the shipping of the more enpriferous ore. During the ensuing year we propose to con-

tinue the exploration of the Deep, California and Josie territory, and to restart work in the No. 1 mine which will lead to our return to exploration of the northern part of our ground."

Stopping cost for the year totalled \$81,081.34, or \$3.44 per ton of ore; diamond drilling cost in all \$5,021.06, or 21 cents per ton of ore; together \$3.65 per ton of ore.

The average metal contents of the 9,467 tons of ore concentrated were: Gold, 0.094 oz., and copper 10.4 lb. a ton, and of the 828 tons of concentrate produced, gold 0.5978 oz., silver 0.829 oz., and copper 30.44 lb. to the ton, having a total value of \$17.48 per ton. Concentration cost was \$0.819 a ton of ore treated.

The gross value of ore shipped was \$313,922.22, or \$20.02 a ton. The proportions of the several metals contained in the ore were as follows: Gold 0.5077 oz. a ton at \$20 an oz., \$10.16; silver, 1.517 oz. a ton at 53.6 cents an oz., \$0.81; copper, 55.5 lb. a ton at 16.31 cents a pound, \$9.05; total, \$20.02.

As a result of mining operations the sum of \$110,400 was remitted to the head office in London.

Josie Mine Report for January.

The Josie mine report for January, 1916, of the company's managers at Rossland, just received from the London office, is as follows: There was shipped during January 1,188 tons of ore and 50 tons of concentrate. Shipments were low owing to inability, through snow and bad weather conditions, of the Canadian Pacific Railway to provide transportation facilities. The receipts from the smeltery were \$12,081 in payment for 970 tons of ore, and 2,194 for 54 tons of concentrate; sundry receipts were \$806; total receipts, \$15,101.

Estimated working costs for the month were for ore production \$5,320 and concentrating \$400; together \$5,720. Other expenditure was: On capital account (concreting shaft), \$400, and on development, including diamond drilling, \$8,896; together \$9,296. Total of all expenditures during month was \$15,016.

DRILLING AT FLIN FLON LAKE.

Sudbury, March 23.—The Tonopah Mining Company of Nevada has placed a large contract for diamond drilling with the Smith & Durkee Diamond Drilling Company. The first drill on this contract was shipped from Sudbury on Tuesday.

The Tonopah Mining Company have secured thirty sulphide claims in the Schist and Flin Flon lakes district. H. C. Carlisle is in charge of the development work which was begun early in last week. Seven tons of supplies were sent up about ten days ago. Camps are being built and a clearing made for the erection of additional buildings. A large gang of men will be taken on with the coming of warm weather.

The diamond drills at Flin Flon are shooting down through the ice at a small lake near the Apex claim. It is proposed to drill on the ice as long as possible before the break up, when the work of drilling will be shifted to the shore. A thorough test of the orebody will be made, and it is stated a dozen holes and more will be driven through the sulphides to reasonable depths. Mr. Durkee says the drills will make 750 feet a month under normal conditions.—Sudbury Journal.

GRANBY.

Directors of the Granby Consolidated Mining Company have declared a dividend of \$1.50 a share. The previous dividend—\$1.50—was paid February 1.

PERSONAL AND GENERAL

Mr. Rex Taylor is at the Wettlaufer mine in South Lorrain, having accepted the position of manager of Dr. C. V. Comfort's company.

Mr. T. W. Gibson and Prof. Young of Toronto, members of the Ontario Nickel Commission, have arrived in England.

Mr. G. G. S. Lindsey of Toronto, past president of the Canadian Mining Institute, has completed the work which took him to China a year ago. He has been asked by the Chinese Government to draft new mining laws for China.

Mr. W. E. Segsworth and Mr. R. F. Segsworth have returned to Toronto after visiting the Seneca and Mercer mines. The Seneca is nearly worked out. The Mercer has shipped its first car of ore and development will be carried on energetically.

Mr. E. V. Buckley, manager of the Queen gold mine and stamp mill at Sheep creek, Nelson mining division, British Columbia, returned a few weeks ago to the mine from Wisconsin, whence he had been called following the death of his son-in-law in that state.

Mr. J. Cleveland Haas, of Spokane, was in Ainsworth camp, British Columbia, last month, looking into the progress made in development work on the Nicollet group of claims, under bond to the Kootenay Development Co., for which he is consulting mining engineer.

Mr. Frederic Keffer, of Keffer & Johns, mining engineers, Spokane, Washington, was in Vancouver lately, in connection with the purchase of machinery for use on a mining property in Yale district, B.C.

Mr. C. H. McDougall, formerly superintendent of the Sullivan lead mine, in East Kootenay, B.C., but for some time past very busily occupied as engineer of construction at the Consolidated Mining and Smelting Co.'s smelting works at Trail, has resigned his position there and gone to Nova Scotia to train for active service in Europe in the British Army.

Major J. Richardson Roaf, who prior to the outbreak of the war was manager for the Pacific Coast Coal Mines, Ltd., with collieries at South Wellington, Morden and Suquash, Vancouver Island, B.C., now of the 143rd Battalion, British Columbia Bantams, is to have command of a new tunnel company to be formed and trained at Nanaimo, B.C. It is stated that a tunnel company usually consists of about 300 men to be engaged in driving tunnels and other underground work at the front.

Mr. D. H. Browne, of New York, was in Toronto and Copper Cliff last week.

Mr. Geo. Guess was at Sudbury last week in connection with the smelter smoke cases being heard there.

Mr. Percy Hopkins, of the Bureau of Mines, who reported last summer on the Kowkash district, expects to make further examinations there this summer.

Mr. Frank Loring has examined the Jamieson claims in Robb township. The property is being developed by a company in which Mr. Duncan Chisholm, of Toronto, is interested.

Mr. Thos. McGuckie, for several years general superintendent for the Western Fuel Co., operating coal mines near Nanaimo, Vancouver Island, B.C., is now at Drumheller, Alberta.

Mr. J. J. Spry, who after retiring from the position of superintendent of the Eureka copper mine, near Nelson, B.C., when the British Columbia Copper Co.

relinquished its option of purchase on that property, removed to the Cobalt district of Ontario, was married in Toronto recently.

Mr. E. E. Ward, at one time superintendent of the Silver Hoard silver-lead mine, in Ainsworth camp, B.C., has for some time past been with the Granby Consolidated Co. at Anyox, Observatory Inlet, B.C.

Dr. C. V. Comfort of the Comfort Mining and Leasing Company has returned to Rochester from Cobalt. His company is reopening the Wettlaufer mine.

Mr. Robert Livermore has returned to Cobalt after visiting the St. Anthony gold mine which the Kerr Lake Company is now interested in.

Mr. C. A. Foster has been in Toronto recently in connection with litigation over control of the Tough-Oakes.

BOSTON CREEK

A preliminary report and geological map of the Boston Creek district is being prepared by the Ontario Bureau of Mines. It is probable that Mr. A. G. Burrows and Mr. P. E. Hopkins will do some further geological work in the district early this summer.

KOWKASH.

There will probably be considerable prospecting in the Kowkash district this summer. In anticipation of this the Ontario Bureau of Mines is publishing a report and geological map prepared by Mr. P. E. Hopkins. The map is ready for distribution and the report should be printed by the time this copy of the Journal reaches our readers. Those wishing copies should apply to the Department of Lands and Mines, Toronto.

CHAMBERS-FERLAND.

Alladin Cobalt appeared in the list of shippers from Cobalt last week, sending out a car load of high grade ore from the Chambers-Ferland mine. Chambers-Ferland is controlled by Alladin.

MR. LINDSEY TO DRAFT MINING LAWS FOR CHINA.

A despatch from Pekin says that G. G. S. Lindsey, the well-known lawyer and mining man, having concluded the negotiations connected with mining concessions which have occupied him during the past year, has been engaged by the Chinese Government to draft new mining laws for China.

FLOTATION PLANTS FOR COBALT MINES.

Cobalt.—Good progress is being made in the installation of the new flotation plant at the Buffalo. The entire plant is being changed over and the work of taking out the old machinery to give room for flotation cells is being rushed.

It is estimated that the new 150-ton flotation plant being installed at the McKinley-Darragh will save an additional 500 oz. a day by high extraction. The ore reserves at McKinley-Darragh are estimated at 1,875,000 oz. On what is known as the blind vein, there is good milling ore for a width of 30 ft., at the 250-ft. level, and extending for several hundred feet.—Cobalt Nugget.

LALLY GOLD MINES, LTD.

Mr. J. Craig Watson is arranging for resumption of operations on the Lally claims in Turnbull Township. Tenders are being asked for the deepening of the shaft to 200 ft. and for timbering.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND SOUTH LORRAIN

Oil flotation is to be tried on a considerable scale in the Cobalt camp. The McKinley-Darragh mill is already installing a 150-ton plant to treat their slime. It is expected that the plant will be running in May. The concentrating tables are being pulled out to make way for the new process. Twenty-five tables are to be taken out to make room for the flotation plant. Six rougher cells are to be installed and two cleaner cells. The slime tailings in a Cobalt reduction plant run from five to seven oz., and Mr. Callow, whose process is being adopted, is sanguine that he can reduce these to two oz. and perhaps one. The installation is inexpensive, and the cost of running the plant not great.

The Buffalo Mines, always the pioneer in flotation in Cobalt, has decided to erect a 600-ton plant in order to treat their tailing pond.

The Nipissing is installing three units at the low-grade mill and several other companies are experimenting with the process.

In the same connection it is very interesting to record the fact that pine oil has been refined with complete success at the Buffalo mill from wood waste in Northern Ontario. The success of these experiments, in which Mr. T. R. Jones of the Buffalo, and Mr. A. A. Cole participated, was so pronounced that the attention of the Department of the Interior was called to the matter and Dr. Bates was sent up. He spent a whole week in the camp and appeared most favorably impressed with the prospects. As to the commercial possibilities, one of the large oil corporations sent up their head chemist to make his own investigations, and he, too, was quite impressed with the possibilities of the situation. The refining would have to be undertaken on a very large scale to make it commercially feasible, but good progress has already been made to accumulate no little data on the matter.

McKinley.—There has been a marked improvement in the position of the McKinley-Darragh-Savage in the past two or three months. A very large tonnage has been developed below the 200-ft. level of the mine. Previous to this year it was assumed that there was no ore to speak of below the 200-ft. level, but this has been proved to be a complete fallacy. There is on the Blind vein at the 250-ft. level a very large body of milling ore. Its maximum width is no less than 55 ft., but its average width is 30 ft. and its milling value is about 15 oz. The development on the Cobalt Lake fault, while it has not yet yielded anything tangible in the shape of ore reserves, is perhaps even of greater importance still. Below the 250-ft. level the winze sunk parallel to the fault was in ore for 30 ft. It is now down about 100 ft. vertically, and while the hanging wall is Keewatin, the foot wall is in excellent conglomerate. This makes the possibility of opening up ore shoots on lower levels of the mine quite bright.

Altogether ore reserves at the end of the year are shown to be 1,200 tons more than at the end of 1914 and containing 1,875,000 oz. This is 257,820 oz. less than ore reserves were declared at in 1914 owing to the fact that the grade of mill rock is lower.

A very interesting development has also occurred under the lake at the 75-ft. level. This portion of the property is now quite free from water and is quite safe and a raise is being put through to the surface. The

old Discovery vein—the first vein to be found in Cobalt—was opened up for six to 17 inches wide. While it is cobalt and not high grade, it and the adjacent wall rock can be mined at a good profit. It is instructive to note that this vein had been completely missed by the pioneers of the camp. It was a foot back from the fault in the hanging wall and had been given up.

If the flotation system is successful it will result in the treatment at a profit of much lower grade milling rock than at present. It is reckoned, for instance, at the McKinley-Darragh that it will be possible to save by higher extraction no less than 500 oz. a day.

The McKinley-Darragh has done so well that it has maintained production and dividends and yet increased its ore reserves: the reduction in ore reserves is entirely due to the fact that the Savage mine has not responded to development as well as formerly. There is still quite a little mill rock at the Savage and it is more than paying expenses, but if further ore shoots are not soon found this subsidiary of the McKinley-Darragh will have to be shut down.

Foster.—Considerable interest is being taken in the development of the old Foster under the auspices of the leasing company, the Glen Lake Cobalt Mines, Ltd. This company and its predecessor, the Foster Leasing Co., has pegged away at development in this section of the field without much encouragement for about two years. It is true that from time to time short shoots of high grade ore have been found and mined near the Lawson line, but they were soon stoped out. Recently in driving to the west on a series of calcite veins a shoot of very rich ore was encountered. This shoot was not more than 15 ft. long and the vein is two inches wide, but since it is in good conglomerate there is a fair chance that it is but the first of further lenses of rich ore. From the old Foster shaft a long cross-cut has been driven under Glen Lake until now it is about 70 ft. from the Bailey line at the 210-ft. level. A winze is now being put down to the Keewatin contact. On ascertaining the horizon at which it is considered best to prospect, a cross-cut will be driven parallel to the Bailey with the expectation of picking up extensions of the Bailey veins.

No ore has yet been found under Glen Lake, although the Penn-Canadian has conducted some exploration in this direction, too. But the formation is favorable and the recent strike on the Foster will without doubt lead to further energy in the prosecution of the work.

Prospecting at Cobalt.—While the keenness with which gold prospects are sought is far more apparent than silver there is nevertheless a desire on the part of capital to discover whether there is not some good in some of the old prospects around Cobalt that has been overlooked in previous exploration. There is little doubt that both the John Black and the Ophir will be working in the spring. It is quite probable that there will be a merger of these two companies. The Adanac Cobalt has some fine ore but the vein is broken and not well defined. The Shamrock is working. The Gifford has been pumped out. The Rochester is working. The Peterson Lake Mining Company is working the Reliance claim.

Wetlaufer has already been dewatered by a company known as the Comfort Mining and Leasing Co. Dr. Comfort is the president of the company and it is well backed. The water has been pumped out to the fourth level and drills will be running before the end

of the month. The Bellellen is being worked under lease by a Haileybury syndicate and some high-grade has already been taken out and sacked. Leads opened up are very promising.

In Gowganda, in addition to the Miller Lake-O'Brien, the Reeves-Dobie is working the Bishop. The Powerful Company is operating near Calcite Lake, and the Barbara has a small gang of men at work on Wigwam Lake.

PORCUPINE, KIRKLAND LAKE AND BOSTON CREEK

At the 100-ft. level of the **R. A. P. Syndicate** enough drifting has been done to prove that the prospect is doing very well indeed. One hundred feet of drifting has been done both east and west. To the west there is now seven feet of ore which will undoubtedly give a very high grade of mill rock. The sulphides are very fine and there is plenty of free gold. To the east there is a smaller width of ore, but as this drift is heading towards the rich shoot found on the surface of the Kenzie vein there cannot be a very long stretch of it without good values. Both these claims are controlled by the R. A. P. Syndicate, although in varying proportions, Messrs. A. M. Scott and J. P. Bickell having recently purchased an interest in the Kenzie claim. The development seems very important indeed.

The **Crown Reserve** has also been very fortunate in striking good ore on their optioned claims in Paeaud Township, near the Boston Township line. They had got down no more than ten feet when the vein widened out to ten inches, and the ore became very rich. The ore is full of sulphides and there is much free gold. The strike was made on the McCrea claims, three of which the Crown Reserve has under option. This early success will encourage other companies to venture into Boston Creek.

At the **Miller Independence** the plant is now running and much quicker progress will be made with the opening up of the prospect.

There are no lack of purchasers for prospects at reasonable working option prices.

At Swastika the Trethewey has pumped out the **Lucky Cross** mine and is now busy sampling the underground workings. The Swastika mine has been closed down.

It is understood that arrangements are now being made for the opening up of the **Wright-Hargraves**, a prospect which has lain idle much longer than could have been anticipated considering the excellent prospects it has of making a mine. It lies directly on the fault plane between the Tough-Oakes and the Teck-Hughes, and has a very spectacular showing on the surface. But it has never been possible to harmonize the views of the men owning the property. Now there is every probability that it will soon be worked. Beyond some stripping and open-cutting no work has ever been done on it.

In the Porcupine camp there has been a very general desire to open up old prospects, but the snow is so deep that save in special instances development has been postponed until there is less snow to shovel.

In **Deloro** the old Standard is being worked by the Porcupine Premier, the Ankerite claims are under option to Mr. C. E. Smith of Toronto, the Kilroy and McCrea claims are being worked by a Toronto syndicate, the Dominion Rand has ordered a plant and is now installing it, five thousand feet has been contracted for

on the Chisholm veteran claim and other options will be taken up as soon as the spring thaw comes.

Mr. Trethewey is proceeding to put the **West Dome** in shape for operations this summer. While the cyanide plant is being installed the Dome Lake mill has been closed down, although mining is proceeding on the same basis as ever.

The **Porphyry Hill** is under option to the Gold Bullion Company, but will not be worked until the spring is farther advanced.

The **Dome** mine is now running through the mill ore taken in sinking the new central shaft. The location of the new shaft was selected with the view of its being in barren ground. To the 600-ft. level it was, but below that level an unsuspected ore shoot was struck and values are of good milling quality for the whole width of the shaft. Production was slightly less in March, amounting only to \$169,000. Tonnage was slightly higher but grade was lower. The two tube mills have arrived and the remodelling of the mill is proceeding very rapidly.

It is satisfactory to note that values in the ore found in the basalt at the 1,275-ft. level of the **Hollinger** approximate much closer to the upper levels than those obtained from the winze below the thousand-foot. The winze has been sunk on the main vein in the quartz porphyry and the values have been quite low. This quartz porphyry at the 1,275-ft. level has given place to basalt, as the management expected it would, and it is reassuring to note that there is no diminution in values. The winze was not selected because of the character of the ore at this particular spot—on the contrary, this is the one lean spot on the main vein—but it was located because of its advantage in the working of the mine.

The ore shoot on the Vipond at the 400-ft. level continues to hold out very well. In the middle of the month it was developed for over 160 feet and had an average gold content of \$13 over the width of the stope. This is the best ore shoot yet developed on this property. At the 500-ft. level the vein has not yet been definitely picked up. The fatality at the mine when a Finn was killed by a fall of rock is the first serious accident that has happened, although the mine has been working since the very early days of the camp.

BRITISH COLUMBIA

A recent noteworthy event in connection with mining in Kootenay district of British Columbia is the fact that the total of ore receipts at the Consolidated Mining and Smelting Co.'s smelting works at Trail for the week ended March 2 was the largest weekly total on record. The quantity was 11,126 tons; previously, the highest total was 10,994 tons, for the week ended March 11, 1915. Mines owned and operated by the company contributed by far the greater part of the recent record quantity; these were the Centre Star and Le Roi, at Rossland, 6,873 tons; the Sullivan and St. Eugene, in East Kootenay (the latter only 94 tons), 2,361 tons; and the No. 1, in Ainsworth camp, 362 tons. The total from the company's mines was 9,594 tons, and of custom ores, chiefly from Rossland and the State of Washington, 1,532 tons. The increased quantity from the Sullivan mine is understood to have included zinc as well as lead ore, for the company is expected to soon be operating its newly-installed electrolytic zinc plant. Ore receipts from Slocan mines were small during three weeks from February 10 to March 3, but that was probably due to the heavy snowfall that im-

peded mining and railway transportation work temporarily, for there was a return to normal quantity for the first week in March.

East Kootenay.

The Monarch mine, in Golden division, North-east Kootenay; the Lead Queen, in Windermere division; Central East Kootenay; and the St. Eugene, in the southern part of Fort Steele division, are three small shippers of ore to Trail on this year's list. From each there has been received at the smelting works two shipments. While the total quantity received this year from all three mines is only 261 tons, it is pleasing to note even this much production being made in widely separated parts of this big district. Of course, the comparatively big production of the Sullivan mine, also in Fort Steele division, of 11,600 tons in 67 days of this year to March 7, inclusive, an average of 173 tons a day, is in strong contrast to the small output mentioned above, but since small producers are sometimes developed in due time into big ones, the more there are being operated in a mining district, the better the outlook for its future.

There is not much news coming from the coal fields just now. The following statement, reported to have been made by Mr. Elias Rogers, of Toronto, president of the Crow's Nest Pass Coal Co., operating coal mines at Coal Creek and Michel, and coke ovens at Fernie and Michel, in South-east Kootenay, is of interest:

"January was rather a trying month for us, climatic conditions having been the most severe for many years. The heavy snowfall prevented movement of trains, with the result that we could not get more than two or three trains a week. Moreover, it was impossible for our men to work during the most severe weather. Conditions were decidedly abnormal, but, despite this, our net earnings for the month of January were much better than we expected.

"On March 31st we will pay a dividend of 1 1-2 per cent. We are not announcing this as a quarterly dividend, just at this time. We are buying from the Canadian Pacific Railway Co. a seven-mile branch from its Crow's Nest main line, and will be making large capital expenditure on this account. Our financial year which closed last December 31 was a much better one than the previous year and there was improvement all along the line. All our debts have been liquidated, and we now have more than \$300,000 cash in bank. The outlook for present year is of the best."

West Kootenay.

Ainsworth.—This year's ore-shippers from Ainsworth division so far have been the Bluebell, Cork-Providence, Florence, Highland, Martin, No. 1, and Utica mines. The total of receipts at Trail from these mines to March 7, inclusive, was 3,545, of which the Consolidated Mining and Smelting Co.'s No. 1 mine shipped 1,901 tons and the Bluebell 1,203 tons.

Slocan.—Shipments of silver and silver-lead ores from this district to Trail have not been large this year, the total from the two Slocan divisions to March 7 having been only 2,119 tons, of which three small high-grade mines in Slocan City division together sent 72 tons, while a dozen mines in Slocan division shipped 2,047 tons. These figures do not include shipments of zinc ore and concentrate, nor the output of the Surprise mine, which is sent to the United States. Shipments of silver-lead ore and concentrate from the Standard totalled 928 tons, Slocan-Star 268 tons, Rambler-Cariboo 236 tons, Galena Farm 163 tons, and Ruth 134

tons; the remaining 318 tons was the total of shipments from the Howitt-Lorna Doone, Lucky Thought, Noonday, Reco, Apex, Yakima, and Comstock.

Rossland.—This year's output of ore from Rossland mines to March 7 has averaged about 900 tons a day, the total for that period received at Trail having been 60,355 tons. Most of this ore was from the Consolidated Co.'s Centre Star and Le Roi mines, with the Le Roi No. 2 Co.'s Josie group also a shipper. One carload was from the Velvet mine, but that was the only shipment made from other parts of Rossland camp.

Revelstoke.—The Lanark mine, in Revelstoke mining division, has shipped two cars of ore to Trail this year, together 60 tons.

Yale.

Kamloops.—The Iron Mask mine, in Kamloops division, continues to ship ore to Trail. Seven lots have been received this year at the smelting works, a total of 403 tons.

Nicola.—A little ore is being sent from the Nicola division to the British Columbia Copper Co.'s smelter at Greenwood. Now that the Kettle Valley railway gives direct connection with Boundary district smelting works, there is a probability of occasional small shipments being made from claims in this division now being developed.

Omineca.

The discovery of what is described as "a new mineral belt in the vicinity of White Sale and Emerald Lakes, south-west of Ootsa Lake," has been reported by the Omineca Herald, a newspaper published in the heart of the Skeena country, Omineca mining division. Zinc ore is stated to occur on the White Sale Lake property, while from the Lead Mountain mineral claims, consisting of five groups with a total of 27 claims, samples of ore assayed have given value in gold, silver, lead, and copper. Up to the present access to the new camp has been from Houston, on the Grand Trunk Pacific Railway, but there seems to be little likelihood of that route being used eventually for sending out ore, so it is suggested that an outlet by way of the head of Dean Channel may be found. In the 1914 official report of Mr. Stephen H. Hoskins, of Hazelton, gold commissioner for Omineca mining division, there was made mention of this part of the big area under the jurisdiction of that official: "During the summer of 1914 ledges of free-milling gold ore were discovered in the vicinity (of Sibolia creek), which resulted in 42 mineral claims being recorded. From reports it would appear that the country is difficult to get into; all travel so far has been from Houston, but it is suggested that an easier way may be found from Gardner canal by proceeding up the Kemano river."

SILVER PRICES.

	New York.	London.
March—	cents.	pence.
11.	56¾	27
13.	56¾	27
14.	56¾	27
15.	56¾	27 1/16
16.	56¾	27 1/8
17.	57	27 3/8
18.	57	27 3/8
20.	57¾	27¾
21.	57¾	27 1/2
22.	58½	27¾
23.	59¾	28 1/2

MARKETS

NEW YORK MARKETS.

March 23, 1916—Connellsville Coke—

Furnace, spot, \$3.25 to \$3.75.

Contract, \$2.50 to \$3.00.

Foundry, prompt, \$3.75 to \$4.00.

Contract, \$3.25 to \$3.75.

March 23, 1916—Straits Tin, f.o.b., nominal, 49.50 cents.

Copper—

Prime Lake, nominal, 27.25 to 27.50 cents.

Electrolytic, nominal, 27.25 to 27.50 cents.

Casting, nominal, 25.75 to 26.00 cents

Lead, Trust price, 7.00 cents.

Lead, outside, nominal, 7.87½ to 8.00 cents.

Spelter, prompt western shipment, nominal, 17.55 to 17.80 cents.

Antimony—

English brands, nominal.

Chinese and Jap., 45.00 cents.

American, 45.00 cents.

Aluminum—nominal.

No. 1 Virgin, 98-99 p.c., 59.00 to 61.00 cents.

Pure, 98-99 p.c., remelt, 57.00 to 59.00 cents.

No. 12, alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$200.00.

Platinum—Nominal, \$88.00.

Cobalt (metallic), \$1.25.

Silver (official), 59.75 cents.

Metal Products—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 34.00 cents.

Copper wire, base, 29.00 to 29.50 cents.

High Sheets, brass, base, 38.50 to 40.50 cents.

Seamless brass tubing, 42.50 to 44.50.

Seamless copper tubing, 43.50 to 45.50 cents.

Braided tubing, 47.50 to 49.50 cents.

Brass wire, 38.50 to 40.50 cents.

Brass rods, 38.50 to 40.50 cents.

Sheet, zinc, f.o.b. smelter, 25.00 cents.

McIntyre.	.94	.93½
Pearl Lake	.00¼	....
Porcupine Crown	.75	.65
Porcupine Gold . . . . .	....	.00¾
Porcupine Imperial	.03¼	.03
Porcupine Tisdale	.02	.01½
Porcupine Vipond	.69	.66½
Preston.	.04½	.04¼
Teck-Hughes.	.20	.19½
West Dome	.17½	.16¾
Gold Reef	.02	.01½
Moneta.	.13	.11
McIntyre Extension	.30	.27
Dome Con.	.20	.15
Imperial Reserve	.08¼	.08
West Dome Con.	.25½	.25¼
Schumacher.	.45	.40
Adanac. . . . .	....	.60
Bailey.	.05¾	.05½
Beaver.	.42	.41½
Buffalo.	1.00	.75
Chambers Ferland	.24½	.23
Coniagas.	4.85	4.75
Crown Reserve	.50	.48
Foster.	.12	.10
Gifford.	.06¼	.06
Gould Con.	.00½	.00¼
Great Northern	.05	.04½
Hargraves.	.05	.04½
Hudson Bay . . . . .	....	26.00
Kerr Lake	4.50	4.35
La Rose . . . . .	....	.63
McKinley-Darragh.	.48	.44½
Nipissing.	.07½	.07¼
Peterson Lake	.27¾	.27½
Right of Way	.05	.04½
Shamrock Con.	.17	.15
Seneca Superior	.60	.55½
Temiskaming.	.58	.57½
Trethewey.	.17	.14½
Wettlaufer.	.08	.07½
York Ont.	.01¾	.01½

NEW YORK STOCKS.

March 24, 1916.

	Open.	High.	Low.	Close.
Allis Chalmers	30¼	....	....	....
Crucible Steel	89¾	90¼	86¾	88½
Am. Smelter	101½	101¾	100½	101¼
Anaconda.	86½	86¾	86¾	86¾
Beth. Steel	495	....	....	....
Chino.	54¾	54¾	53¾	53¾
Col. F. & I.	46¾	46¾	46	46
Con. Gas	136¼	136¼	136¼	136¼
Cal. Petrol	23¾	23¾	22¼	22½
Dome.	25½	25½	25	25
Gen. Electric	167¾	167¾	167	167½
G. N. Ore Cer.	44¾	44¾	44¾	44¾
Goodrich.	73	....	....	....
Int. Nickel	46¼	46¼	46¼	46¼
Mex. Petrol	107¼	108¾	106	107¾
Nevada Copper	15½	17	15½	16¾
Ray.	23¾	23¾	23¾	23¾
Tenn. Copper	53¾	53¾	52½	53
Texas Oil	197	197¼	195	196
U. S. Steel	85½	85½	84¾	85
do. pref.	116¾	....	....	....
do. fives	104¾	....	....	....
Utah Copper	82	82	81	81½

TORONTO MARKETS.

March 24—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 10 cents per lb.

Tin, 53 cents per lb.

Antimony, 45 cents per lb.

Copper casting, 30 cents per lb.

Electrolytic, 30 cents per lb.

Ingot brass, yellow, 13c.; red, 19 cents per lb.

March 24—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

STANDARD STOCK EXCHANGE.

March 24, 1916.

Mines—	Ask.	Bid.
Apex.	.05½	.05¼
Dome Extension	.38¼	.38
Dome Lake	.29	.28
Dome Mines	.26	.25
Foley.	.56	.50
Hollinger.	.27½	.27
Homestake.	.50	.45
Jupiter.	.22½	.22¾

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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VOL. XXXVII

TORONTO

No. 8

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*The Sampling and Assaying of
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The Kowkash Gold Area.

The Nipissing Report.

Coal Mining in Alberta.

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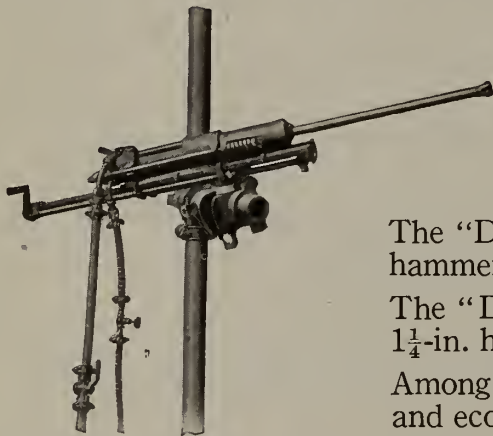
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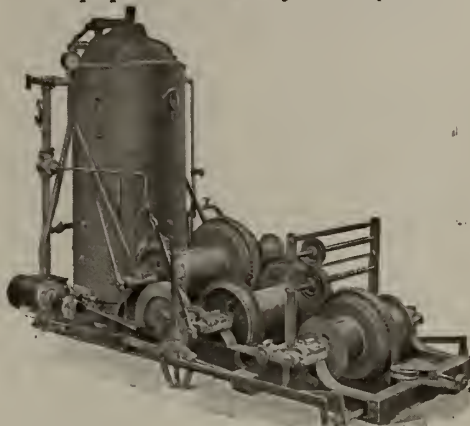
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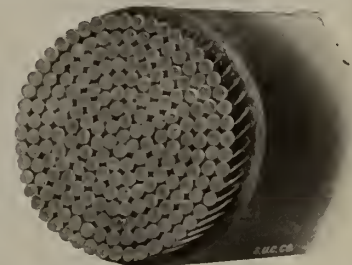
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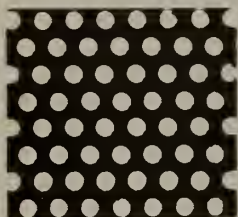
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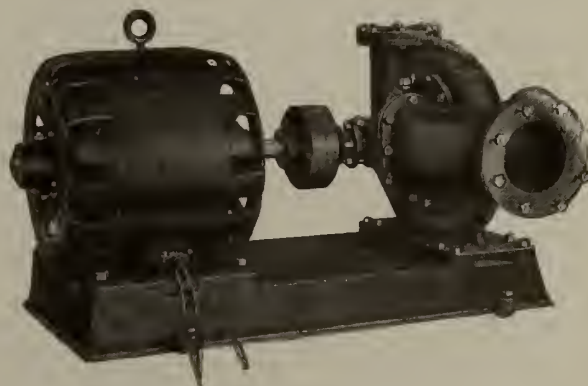
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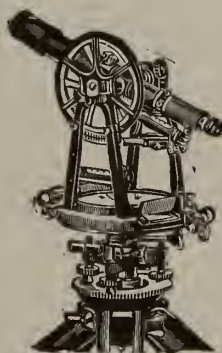
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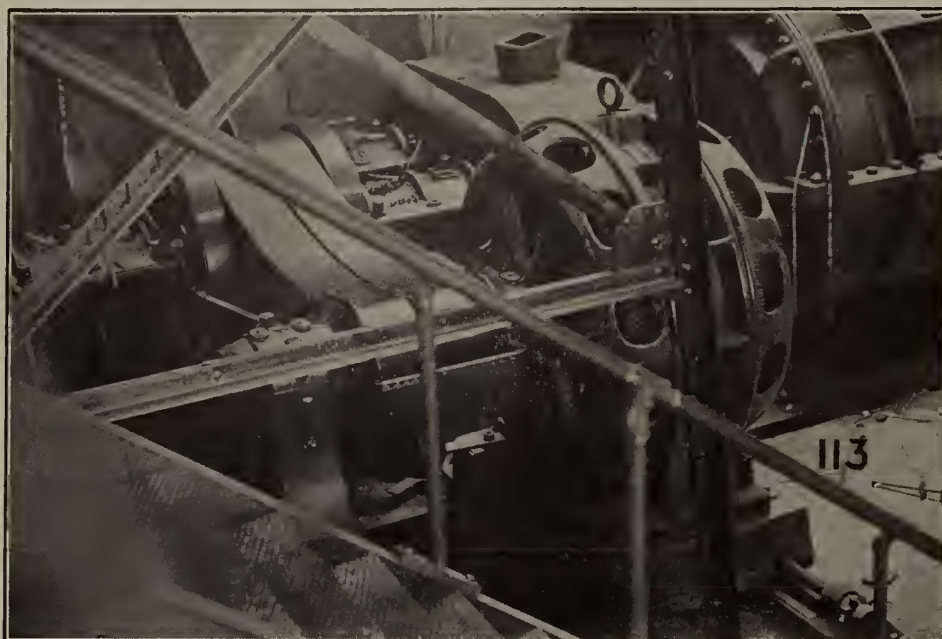
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, April 15, 1916.

No. 8

The Canadian Mining Journal

With which is incorporated the

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Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

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Editor

REGINALD E. HORE

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CIRCULATION

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THE NIPISSING REPORTS

The reports of the Nipissing Mines Company and the Nipissing Mining Company for the year 1915 have been issued and are unusually interesting at this time. They record satisfactory progress during a trying period. They illustrate some desirable and also some questionable features of company reports.

Mr. E. P. Earle, president of the Nipissing Mines Company, the holding company, reports a production during 1915 of 4,097,391 oz. silver valued at \$2,222,256. Net receipts were \$1,441,427. Production cost was 19.06 cents per oz. silver. \$1,200,000 was paid in dividends and \$183,484 added to surplus, the total surplus now being \$1,786,260.93. The ore reserves contain nearly nine million oz. of silver and recent developments indicate the possibility of important additions being made to the reserves. The area of ground still to be prospected has, of course, decreased, but a large production for a few years at least is assured. These statements indicate that large profits are expected from operations during the next few years.

Mr. R. B. Watson, general manager, reporting to Mr. David Fasken, president of the operating company, Nipissing Mining Co., Ltd., gives an interesting summary of operations during the year, and gives instructive figures on the costs of mining and treating the ore.

From the reports of Mr. Earle and Mr. Watson it is evident that the Nipissing is a very valuable mine with large reserves and good prospects. When we turn to the balance sheet of the Nipissing Mining Co., however, we find that the mining property is valued at only \$250,000—an absurd figure.

The Nipissing Company is not alone in carrying such ridiculous figures on its books. One might assume that the accountants were more interested in making two columns of figures that would balance than in giving useful information. Rather than omit listing an asset of which the value is not known, they choose an arbitrary value which is known to be wrong. In this case the auditors evidently had some misgivings about passing such a statement for they say: "The mining property of the company is carried at the par value of the stock of your company which was issued therefor." Such balance sheets are unsatisfactory, for the value of the chief asset is not given correctly.

Most mining men have become accustomed to these unsatisfactory statements, and have learned to make their own estimates from other information contained in the reports. They are not likely to be misled. We submit, however, that it would be better to omit statements of value of property rather than to use arbitrary

figures which are not necessarily related in any way to the actual value.

Another questionable feature of the Nipissing balance sheet, in common with many others, is the valuation given to mining plant, equipment and supplies and of ore and bullion at the mine or in transit. In these cases the balance sheet shows the value worked out to two decimal places, giving thus a suggestion of accuracy which does not exist. The accountant does well enough when he estimates the value in dollars. Compared with the value given to the mining property the figures given are accurate to a high degree, but the decimal figures do not increase the accuracy of such statements. The intelligent shareholder would be more interested in knowing what price per ounce of silver was used in estimating the value of ore and bullion still unsold.

The reports issued by the Nipissing Mining Company are among the best which we receive. General Manager Watson always gives a very good account of the work done and gives important information that we look for in vain in many reports. The balance sheets are, however, not as informing as they might be.

In this issue we publish a description of the Kowkash gold area from the report prepared for the Ontario Bureau of Mines by Mr. P. E. Hopkins. The gold discoveries made in the Kowkash area last year attracted considerable attention. The claims staked must be regarded merely as prospects yet, but the discoveries made will doubtless lead to thorough investigation of the district. The report and maps just published by the Bureau of Mines should prove of great service to those who undertake the work.

In a paper prepared for the annual meeting of the Canadian Mining Institute, Mr. J. B. Tyrrell urged the advisability of seeing to it that the mining industry should be represented in Parliament by mining men. Recent debates in the House of Commons at Ottawa and in the Ontario Legislature emphasize the need of reform. Members who loudly claim, for instance, that the nickel question is one of the most important with which the country has to deal, show by their statements that they have not even taken the trouble to inform themselves about the question and that they are depending on equal ignorance on the part of their opponents when they make absurd statements concerning the mining industry. There should be in Parliament enough men familiar with mining affairs to prevent the time of members being taken up by speakers who do not know what they are talking about. Time and the country's money is wasted in these debates. Mining is one of our greatest industries and should be discussed in Parliament intelligently. At present the subject of refining metals in the Empire, and particularly of refining nickel in Canada, is the subject of

much discussion. It is a question of great importance and under the circumstances it might be expected that those who bring up the matter for debate would make some endeavor to familiarize themselves with the facts.

WM. B. THOMPSON.

"Holland" writes in The Wall Street Journal: Probably the name of no man now active in affairs is more frequently upon the lips of men of large affairs, at least in New York, than that of William B. Thompson. Sometimes the estimate is made that his wealth is now so great that he is entitled to rank with the multimillionaires. He is a director of the Federal Reserve Bank of New York and has other banking interests. But it has been principally through his successful exploitation of copper properties, not the least among them being copper properties in Alaska, and also his share in the building of the original Alaska railroad, that he now takes high rank among men directing great enterprises. Of him, as of many others who in recent years have been very successful in industries of various kinds, the public has had little knowledge.

Mr. Thompson received technical instruction at the Columbia School of Mines. From that institution he went forth to begin a career which is now spoken of by those who know something of it as one of the most successful of all the careers made by men who have been occupied with development of mining property.

A CORRECTION.

In discussing on page 158 of our last issue Mr. Clapp's letter on our criticism of his report on oil and gas, we gave as authority for the statement of production of oil in Ontario in 1912, page 229, Vol. 2, Ontario Bureau of Mines Report, 1912. By a typographical error this was printed page 22 instead of page 229.

KIRKLAND LAKE.

The Tough-Oakes mine is making good progress. The affairs of the company have been the subject of much litigation, Mr. C. A. Foster expects, however, that his faction will come out victorious. He has managed to prevent the closing down of the mine, and good results are being obtained in mine and mill.

TRETHEWEY

The Trethewey Company is dewatering the Lucky Cross mine at Swastika.

CROWN RESERVE.

Good results are being obtained on the McCrea claims in the Boston Creek district by the Crown Reserve Co.

ARSENIC.

The price of arsenic has increased considerably lately. It is now selling at about 6 cents per pound. It has sold at less than 2 cents at times.

OUR GOLD MINING SPECIAL.

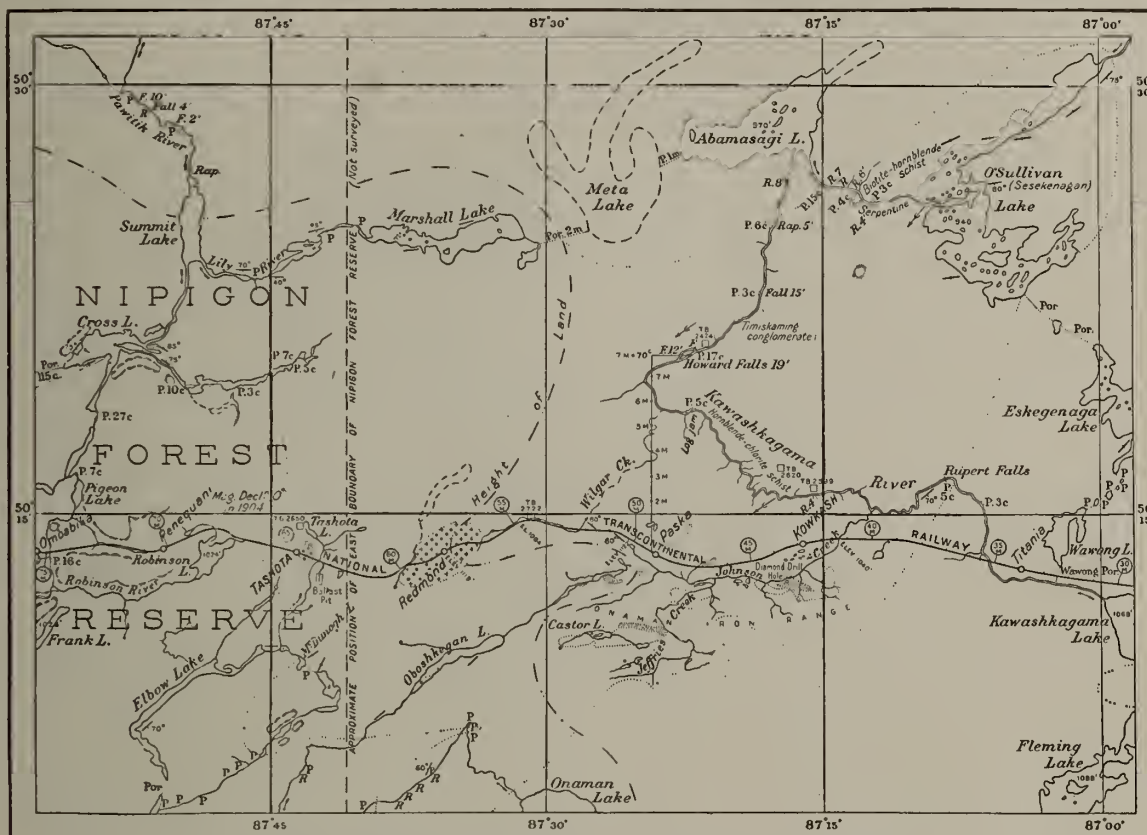
The Canadian Mining Journal will publish next month a special well illustrated issue on the gold mining in Northern Ontario. A large number of copies will be printed, but to ensure getting copies orders should be placed early. All regular subscribers will receive the special issue.

THE KOWKASH GOLD AREA*

By P. E. Hopkins.

In accordance with instructions received from Thos. W. Gibson, Deputy Minister of Mines, the writer left Toronto on September 6th, 1915, and spent six days in making a preliminary investigation of the recent gold discovery near Kowkash, a station 297 miles west of Cochrane on the National Transcontinental railway. A preliminary report was published in the Canadian Mining Journal, Toronto, Oct. 1st, 1915, and a map (No. 24C) of part of Thunder Bay district showing

miles northwest of Kowkash, near Howard falls, on the river Kawa-kash-kagama, which signifies "sparkling water." This name has been shortened to Kawashkagama by the Geographic Board. The railway station called "Kowkash"—an abbreviation or corruption of Kawashkagama—has given its name to the area. The region has so recently been opened up by the National Transcontinental railway that the geological reports have been for the most part of a pre-



THE KOWKASH-TASHOTA DISTRICT, ONTARIO.

A geologically colored map of this area has just been published by the Ontario Bureau of Mines.

the Kowkash gold area accompanied Part I, Volume 24, Report of the Ontario Bureau of Mines, 1915. The writer revisited the area in the latter part of October, 1915, and spent another six days in examining the geology and all the known discoveries. The Kawashkagama river below Johnson creek, part of O'Sullivan lake and the greater part of the route along the railway between Johnson creek and Robinson lake, 25 miles west, were examined. Accompanying this report is a map of the area on a scale of four miles to the inch showing the topography, geology and location of the prospects.

The Kowkash gold area is situated in the central part of the district of Thunder Bay, Ontario, northeast of Lake Nipigon, and is traversed by the National Transcontinental railway. Kowkash station is 297 miles west of Cochrane at about latitude 50° 15' north and longitude 87° 15' west.

Early Exploration and History.

A spectacular gold find was made by E. W. King Dodds on August 21, 1915, on claim T.B. 2424, nine

liminary character and confined to the more important canoe routes.

That part of the Kawashkagama river near the gold find is described by Robert Bell, in the annual report of the Geological Survey of Canada for 1870-1, p. 342; also, by party number 5 in the report on the Exploration of Northern Ontario, issued by the Ontario Department of Crown Lands, in the year 1900, p. 156. In the latter report, E. V. Neelands, geologist, blazed the way for the prospector when he stated "Huronian (Keewatin) rocks, mainly chlorite and other soft green schists, occur in the Kawa-kash-kagama river for about four miles below the Wawong portage to the northern limit of exploration (Howard falls). . . . The most promising district is the country on the Kawa-kash-kagama river below the Wawong portage. Here Huronian (Keewatin) exposures are numerous, mostly chlorite and other soft green schists. Several samples from small quartz veins in this district showed traces of gold, and it might be that careful prospecting in this district would be rewarded."

*Extracts from a report just published by the Ontario Bureau of Mines, Toronto.

W. J. Wilson, of the Geological Survey of Canada, also made a geological reconnaissance survey of part of this area in 1903-4, and his map accompanying the report, which shows the water routes and geology, was very useful to the early prospectors. Robert Bell, W. A. Parks, A. H. A. Robinson and others have described the canoe routes and geology on the western part of the accompanying map.

Up to the present time little attention has been given the Kowkash area by gold seekers, but part of the region was well known to some who prospected for iron on the Onaman iron range along Johnson creek. The iron first attracted the attention of the prospector in 1904, when engineers began the survey of the National Transcontinental railway through this area. R. Flaherty prospected on the range for two seasons, 1906-7, for the United States Steel Corporation, during which time much stripping and three diamond drill holes were sunk. However, the banded red jasper and magnetite and hematite proved to be of too low grade to be workable at that time. E. S. Moore, who spent part of two seasons in examining the range, gives a detailed report on the geology and topography of this area.

From an economic point of view, gold is the chief interest in the region, at present.

E. W. King Dodds made his discovery while walking over the rocky hill below Howard falls, which had been burned clean of moss and trees on the previous day. The news of the rich find caused a rush of about four hundred prospectors to the neighborhood, and 75 or 100 claims were staked within three weeks.

At the time of the writer's second visit at the end of October, no further discoveries had been made in the vicinity of the original find, around which centred the early staking. This was the magnet, however, that drew the prospectors to the locality, resulting in newer finds farther to the south and west. Two gold discoveries have been made farther up the Kawashkagama river, about three miles north of Kowkash station, on the Richardson and Dawson claims. Gold and a telluride have also been found on the Devanney claim near Tashota, 22 miles west of Kowkash, towards the western side of the Keewatin area. In the latter region as much staking has gone on as around the Dodds property. Gold values were obtained near Redmond station at mileage 54.3, from a quartz vein on O'Sullivan lake and other places. Mile posts are marked on telegraph poles along the line of railway west from Grant, a divisional point.

Over 1,000 claims have been staked mainly around Tashota, adjacent to the Dodds discovery, and in the vicinity of the railway between Kowkash and Tashota stations. Nearly 500 claims were recorded at the Port Arthur office up to November 11th, 1915. At the end of October there were about 100 prospectors still in the area.

Topography.

The country has an average elevation of about 1,000 feet above sea level with no great variations in level. There is not a difference of more than about 150 feet between the highest hills and lowest valleys. The most prominent hill seen lies about four miles southwest of O'Sullivan lake.

The continental divide, separating the waters of the great lakes from those of Hudson bay, runs in a tortuous course through the region; but nowhere is it conspicuous as a ridge. A large swamp with streams emerging from either side often forms the watershed.

A boss of red granite, three miles wide, occurs at the divide, altitude 1,118 feet, at Redmond. Towards the northwest of the sheet is Summit lake, a shallow, muddy lake, three miles long by one mile wide, which discharges water both ways, the stream flowing northward towards the Albany being nearly as large as the southern outlet. The country northeast of the height of land is drained largely by the Kawashkagama river, a branch of the Albany.

The average magnetic declination for the area embraced by Map 25a is about one degree west of north.

Following is a brief resume of the geology and a description of the several gold prospects.

General Geology.

The Kowkash area presents pre-Cambrian rocks similar to those found elsewhere in northern Ontario. They are dominantly of Keewatin age, with some Timiskaming sediments and later intrusions of feldspar porphyry, granite and diabase. The younger formations can be separated when the area is mapped in detail. The above rocks cover an area of 600 or more square miles, which is worthy of further prospecting. Surrounding this region are rocks of Laurentian, Keweenawan and Paleozoic age.

The Keewatin consists chiefly of **massive fine-grained chlorite and hornblende rocks which are in places altered to schists**, and which have a nearly vertical dip. Among these rocks are altered diabase, altered basalt showing pillow or ellipsoidal structure, agglomerate and rusty carbonate, so much altered that microscopic examinations are unsatisfactory.

A considerable amount of iron formation occurs on the Onaman iron range, the location of which is taken from E. S. Moore's map.

Cutting the greenstones and closely associated with the iron formation are **narrow dike-like masses and flows of quartz-porphyry or rhyolite**. Exposures may be seen at many places, chiefly around O'Sullivan lake, Howard falls, Onaman iron range and Tashota station. The porphyry contains numerous white quartz phenocrysts, the size of peas, and some feldspar phenocrysts in a fine grained, greyish-white groundmass. The porphyry also contains some quartz stringers, is schistose in places and resembles the quartz porphyry at Porcupine, Goodfish lake and Big Duck lake (north of Schreiber). A sample from the Dodds' claim which was examined microscopically showed large, rounded, angular and broken quartz grains, and albite phenocrysts, partly altered to sericite. The crystalline groundmass consists of quartz, feldspar, sericite, calcite and a little chlorite. E. S. Moore noted tourmaline in the rhyolite-porphyry from near Castor lake.

On the Kawashkagama river at the last portage into O'Sullivan lake is an actinolite rock, below which are numerous serpentine exposures.

Granite and gneiss, possibly of Laurentian age, are shown on the map, but these may include some granites of later age. Much of the gneiss is similar to the Laurentian gneiss in other parts of the pre-Cambrian shield. A. W. G. Wilson notes that the acidic schistose rocks in the Summit-Marshall lake region occupy a very doubtful position between undoubtedly Keewatin and undoubtedly Laurentian.

Conglomerate and slates apparently similar to the Timiskaming sediments in Porcupine and Kirkland lake are found about two miles below Howard falls and one chain from the west bank of the Kawashkagama river. They strike north 65 degrees east and dip

vertically. The pebbles of the conglomerate are rounded and drawn out, and consist of chert, quartz-porphry, amygdaloidal basalt and granite-gneiss. The conglomerate is separated on the north by a few feet of drift from a large volume of pillow lava. Slates standing vertically can be seen at mileages 50.7, 51.7, 53.6 and elsewhere in the area. E. S. Moore has mapped a few exposures of tuff and conglomerate with the Keewatin.

Cutting these older rocks are **fresh-looking, massive granite areas**, probably of Algonian age. A grey granite can be seen at the water tank at Tashota station, which under the microscope shows quartz, albite, microcline and biotite. A large boss of red granite three miles wide forms the height of land, altitude 1,118 feet, at Redmond. It contains microcline showing the gridiron structure, albite with zonal structure, quartz and biotite partly altered to chlorite. Some of the quartz porphyries may be of Algonian age, apophyses from the larger granite masses. The feldspar porphyries are rare. A narrow dike was noticed cutting the iron formation at mileage 56.3 along the railway.

Quartz diabase dikes occur in many parts of the area. Exposures may be seen at mileages 50.3, 50.5, and 56.7 west of Grant station. Large exposures of diabase and gabbro occur south of Tashota, and also about 300 yards north of the Dodds gold find. The only reason for placing these rocks in the Keweenawan is that they are similar in every respect to the Keweenawan diabase at Cobalt and in the Nipigon region. W. J. Wilson notes that the diabase is common in both the granites and schists and does not contain olivine.

Large areas of diabase occur around Lake Nipigon. The occurrence of silver associated with the diabase at Silver islet and Silver mountain, 150 miles to the southwest, suggests the advisability of prospecting these diabase areas for silver.

The region has been heavily glaciated, the ice movement having been from the northeast over the height of land in a general south-55°-west direction.

The area lies near the western edge of the northern Ontario clay belt, which has an extent of about 25 million acres, and is covered in places with stratified clays, sands, gravels and coarse boulders. South of Kowkash station near the railway are numerous terminal morainic hills which contain many kettle lakes. Kowkash station is built on an outwash plain formed from an ice sheet.

Economic Geology.

At present gold is the chief mineral sought for in the area, but there was considerable prospecting for iron in earlier years.

Iron.—The iron occurs on the Onaman iron range, which was examined in detail by E. S. Moore in 1907 and 1908. He found the iron formation to occur in two bands, called the northern and southern ranges, the former extending for nine miles and the latter three miles in an east and west direction. The formation is composed largely of red jasper, often well banded, and magnetite. There are considerable deposits of these minerals, but they are interbanded with much slate and some greywacke.

Gold.—Quartz veins carrying gold values in parts of the area have been known for some time, particularly from the Cross-Summit lake area. A. H. A. Robinson, in 1900, obtained an assay return of 80 cents per ton from a vein on the west shore of Summit lake. Another sample on the Lily river, two miles from Sum-

mit lake yielded \$2.80 of gold per ton. W. A. Parks reports an assay value of \$1 per ton in gold from a sample from Cross lake. In 1900 E. V. Neelands obtained traces of gold from several samples collected along the Kawashkagama river above Howard falls.

Dodds' find in 1915 led to others, particulars of which are given below. The prospectors are still busily engaged in the region, but enough prospecting has not yet been done to prove the prospects.

Other Minerals.

A boulder of pyrite, about three feet across, was reported from a point about two miles northwest of Paska station.

A few specks of native copper were seen in quartz veins near the Tashota gravel pit.

No silver was present in the several samples which were assayed.

Other Resources.

The trees are mostly second growth and consist of small spruce, poplar, balsam of gilead, pine, birch and cedar, along the rivers occasionally attaining a diameter of two feet. On the whole, these are suitable for pulpwood and locally for ties, posts and small timber. Large areas have been recently burned. The east boundary of the Nipigon forest reserve, which is not surveyed, is approximately shown on the map.

Small tracts of the country are suitable for agricultural purposes.

Whitefish, pickerel, pike, suckers and brook trout are plentiful in these waters. The rapids on the Kawashkagama river and the numerous brooks entering the river are famed for their speckled trout, some of which are two feet in length.

Many small undeveloped water powers occur on the rivers. Howard falls on the Kawashkagama river would make an excellent water power. The 19 foot fall here is caused by a hornblende-chlorite ridge through which the river cuts, making a narrow canyon-like gorge fourteen chains long. W. J. Wilson notes that the gorge is from twenty to thirty feet deep, and the water descends in steps and slides varying from one to five feet.

THE MAIN PROPERTIES VISITED.

Dodds..

The original gold find which caused the rush to the area was made on the Dodds' claim, T.B. 2424 about three-quarters of a mile east of Howard falls, on the Kawashkagama river. The quartz vein strikes 10 degrees south of east and dips 75 degrees to the north, thus conforming in strike and dip with the country rock. On the surface, the vein which is one to five inches wide, averages three inches in width. The quartz is somewhat glassy in appearance and largely free from sulphides. An abundance of free gold occurred for four or five feet along the hanging wall part of the vein. On the north side of the vein is a rusty schist band, six inches wide, which is heavily impregnated with iron pyrites. The wall rock is pillow lava (meta-basalt) altered in places to schist. Numerous quartz porphyry dikes up to thirty feet wide occur on the claim.

The claim was optioned by T.B. Caldwell, of Lanark, Ontario, and Messrs. Fraser and Orn. On October 23rd the vein had been stripped for 100 feet, exposing two specks of gold towards the western end, and a 14 foot pit had been sunk. In sinking, the showing of free gold disappeared in a few feet. At the bottom of

the shaft the vein is two inches wide with a foot of pyritous schist on the foot wall, but no gold was visible. A channel sample across twelve inches of the pyritous schist from the bottom of the shaft gave an assay \$2 in gold. Work was suspended early in November. It is reported that arrangements have been made to sink a 150 foot shaft.

Richardson—Loudon—Ogilvie.

During the first week in October, 1915, gold was found on Claim T.B. 2599, near the first rapids on the Kawashkagama river below the junction of Johnson creek. The quartz vein is narrow, averaging about two inches in width over a length of 200 feet. The vein strikes south 85 degrees east and dips about 70 degrees to the south. The rock is Keewatin pillow lava, and near the vein is a biotite granite dike 6 feet wide. Coarse gold could be seen in 6 or 7 places along the vein, and pyrite is also present. Rock outcrops in this vicinity are scarce, but further trenching may reveal larger auriferous quartz veins.

Dawson.

About two miles northwest of the Richardson claim across sand plains and intervening swamps is the Dawson claim, T.B. 2620, where gold was reported to have been found about October 22nd, 1915. The quartz vein strikes north and south for 400 feet and dips about 60 degrees to the east. The vein is lenticular and will average about one foot in width. Chalcopyrite, pyrite and chalcocite are disseminated throughout the rusty quartz. The country rock is a massive, green, altered Keewatin diabase.

Devanney.

On account of obtaining visible gold and high assays from the Devanney claim, near Tashota, 22 miles west of Kowkash station, as much staking has gone on around Tashota as around the Dodds' property.

The Devanney claim, T.B. 2650, lies about one and a quarter miles north of Tashota station on the north-west shore of Tashota lake. The vein strikes south 60 degrees east and dips from 50 to 70 degrees to the southwest. The vein is lenticular varying from a few inches up to four feet in width, and having an average width of a foot or more. It can be traced intermittently for about 600 feet. The quartz is milky, in places rusty, and contains a little fine gold, a telluride in considerable amount, also pyrite and pyrrhotite. A polished surface of the ore shows that there are probably three tellurides present. Three pieces of quartz containing a small amount of the tellurium mineral gave \$27.60 in gold to the ton. The wall rock is a Keewatin greenstone consisting of chlorite, calcite and quartz. Quartz porphyry dikes occur on the claim and in the vicinity. The little trenching that has been done shows the prospect to be an interesting one.

McFarlane—Manion.

At mileage 54.3 west of Grant, or four miles east of Redmond on the north side of the track on claim T.B. 2722, is a quartz-calcite vein, two to ten feet wide in a Keewatin greenstone which is said to extend across several claims in an east-west direction. Mr. McFarlane has sunk a pit 11 feet deep on the vein where it strikes south 70 degrees east and dips 70 degrees to the north. A one-half inch vein of galena occurs near the foot wall. Chipped samples for assay taken in three sections with a moil and hammer across the vein at the bottom of the pit gave as follows:

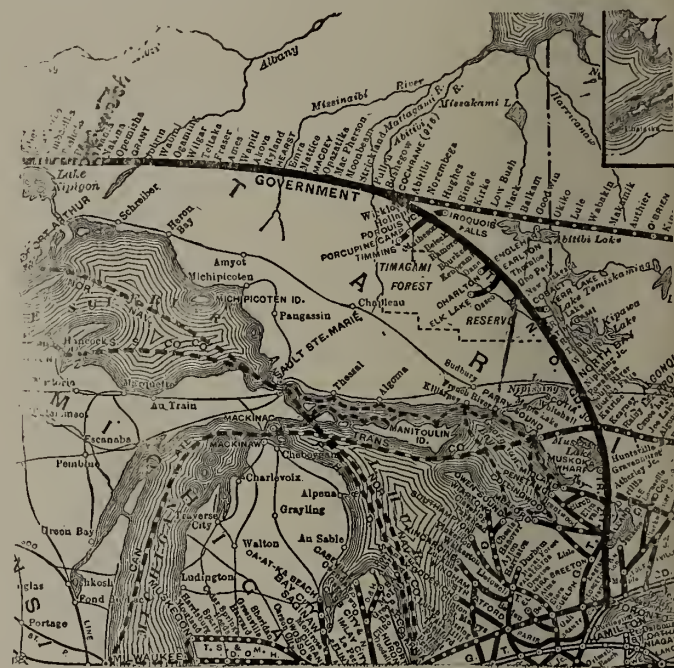
No. 1. 1½ ft. hanging wall part of vein, gold none; silver none.

No. 2. 3½ ft. centre of vein, gold \$1.20; silver none.

No. 3. 1½ in. foot wall part of vein, containing galena, gold \$6.00; silver none.

Conclusions.

The Kowkash area, comprising 600 or more square miles, is similar geologically to other northern Ontario Keewatin areas, for instance, Poreupine. In these schistose rocks quartz veins are plentiful. Gold, at this early stage, is known to be widely distributed.



The Dodds vein contained a small rich pocket of ore, and the Devanney vein carries a telluride in addition to gold. Enough work has not been done to prove that the gold occurs in paying quantities. Prospecting is somewhat difficult in places on account of the heavy overburden, while other parts are rocky and burned. The transportation facilities are excellent on account of the railway and splendid waterways. The area is worthy of thorough prospecting, which it undoubtedly will receive during the coming summer. Besides gold, the prospector should be on the lookout for iron ore and pyrite.

In concluding the writer wishes to express his thanks to W. R. Rogers, topographer, and P. A. Jackson, for the preparation and production of the map.

The assays were made by W. K. McNeill and T. E. Rothwell of the Provincial Assay Office.

MUNRO.

Croesus Gold Mines, Ltd., operating the property formerly known as the Dobie-Leyson, in Munro township, is putting Munro on the map to stay. The shaft has now reached a depth of 300 ft. Mr. Julius Cohen is superintendent. The chief owners are Messrs. Davis and Steindler. Mr. A. G. Kirby is manager.

The Munro Consolidated Co. was developing adjoining property, but since the death of Mr. P. S. Hairston, who was a victim of the American Club fire, the property has been closed down.

THE SAMPLING AND ASSAYING OF MOLYBDENUM ORES

AS PRACTISED BY THE ORILLIA MOLYBDENUM COMPANY, LTD., ORILLIA, CANADA

By B. C. Lamble.

The methods of sampling and assaying molybdenum ores set forth hereunder were adopted and developed after a considerable amount of experimental work, and have been in use in our laboratory on mill heads and tailings, concentrates and ore samples, for the past six months, during which time the mill and refinery treated over four hundred tons of molybdenite ores. Our results have been satisfactory in every way.

Sampling.—The ores received at our plant carry from 1 to 3 per cent. molybdenum, in the form of the sulphide, molybdenite.

The ore is generally shipped from the mines in bags containing from 80 to 100 lb. each. The ore is sampled in the usual way; the final sample ($-\frac{3}{4}$ "") is cut to 400 lb. This is quartered, put into bags and sealed. The sample to be run in the laboratory represents about 100 lb. of $-\frac{3}{4}$ " material. This is run first for moisture. It is then crushed and rolled to pass a 40 mesh screen until only flakes are retained on screen. These are rolled three or four times until fairly clean. We now have two samples: one of fines and one of metallies. Both are weighed, and weights recorded.

The fines are coned and quartered 5 times, being thoroughly mixed after each quartering, till a final sample of some 3 lb. is obtained. This is then pulverized until whole has passed through 100 mesh screens. It is then thoroughly mixed and is then ready for laboratory.

The metallies are mixed and quartered to about one-half pound sample, placed in large iron mortar and pounded with pestle until the whole passes through 40 mesh screen. This is then thoroughly mixed for laboratory.

Assaying.—In the determination of molybdenum the chief troubles met with are: first, the difficulty in getting a complete solution of all molybdenum; second, in low grade ores, which are the general run, the large amounts of iron contained, when precipitated out of solution, retain large amounts of molybdenum, which is difficult to recover, either by re-dissolving, re-precipitating or by washing. For this reason we have found it expedient in this laboratory to take small samples of the fines for the initial treatment and then unite several of the final filtrates for the determination. I might mention here that the ores received and treated contain molybdenite, pyrrhotite, iron pyrites, very small amounts of copper pyrites, with the usual gangue material, quartz, calcite, mica, etc.

Usually ten one gram samples are weighed out into 250 c.c. beakers, 5 c.c. concentrated hydrochloric acid added, beakers placed on hot plate and solution evaporated to dryness, 10 c.c. concentrated nitric acid added, and mass hoiled, addition of nitric acid and hoiling continued till all solubles are in solution, 25 c.c. distilled water added, hoiled, cooled, ammonia added to precipitate iron, etc., solution again hoiled, filtered, precipitate washed with a solution 20 parts water and one of ammonia. The precipitate is dissolved on filter paper with a hot 1 to 1 nitric acid solution, and received in original beaker. Iron is again precipitated with ammonia, solution hoiled and filter-

ed, receiving in beaker containing first filtrate. Each filtrate will now measure about 75 c.c. We combine five filtrates, giving two final filtrates of from 350 to 400 c.c. capacity. These solutions are hoiled till only a faint smell of ammonia is discernable, small piece of blue litmus paper is dropped into the solution, and acetic acid added till solution is barely acid. This is then titrated while hot with a standard lead acetate solution, using a 1 per cent. solution of tannic acid for an outside indicator. The lead acetate solution contains 15.7 grams lead acetate per litre, and it is standardized against a known ammonium molybdate solution, the lead factor multiplied by 0.464 gives molybdenum factor. Twenty-five c.c. of the ammonia molybdate solution is measured into a flask, diluted with distilled water to 100 c.c. and hoiled. The lead acetate solution is run in until a drop of this solution added to a drop of tannic acid in spot plate fails to give a yellow coloration. This is the inverse to the well-known Alexander method for lead.

The flakes are somewhat harder to get into solution. One gram samples are weighed out (in duplicate) into beakers, covered with concentrated hydrochloric acid, and placed on hot plate and solution taken to dryness. Treatment with the acid is continued till no sign of molybdenite is showing. About 20 c.c. of 1:1 ammonia is added and solution hoiled. It will be seen that particles of molybdenite will now appear. This is due to the flakes becoming coated with molybdic acid, which is dissolved by the ammonia, exposing the untouched molybdenite. The precipitate and unattacked flakes are allowed to settle and solution poured through filter, the residue being washed 3 or 4 times by decantation with small amounts of hot water. The residue is treated with nitric acid, and then ammonia till all the molybdenite is in solution. Solution finally titrated as above.

The percentate of metallies to total sample, multiplied by percentage molybdenum found in metallies equals metallic assay. This plus fines assay equals total assay.

For ores containing appreciable amounts of lead, copper, etc., the treatment is the same until point is reached where the ammonia is added. This is added till solution is just alkaline, a few c.c. ammonia sulphide added to precipitate iron, lead, copper, etc., and then a few c.c. in excess. The beaker containing solution set in warm place till precipitate has settled. The whole is then filtered, and precipitate washed with a weak ammonium sulphide solution. The precipitate is then rinsed into beaker and a hot mixture of equal parts nitric acid and bromine water is passed over filter paper to dissolve any adhering precipitate. The whole is hoiled and then re-precipitated with ammonia and ammonium sulphide. Filter and wash precipitate with the weak ammonium sulphide. The combined filtrates will show a deep brown color if much molybdenum is present. The solution is made just acid with hydrochloric; this theoretically will throw all the molybdenum, but it is best to pass a rapid stream of hydrogen sulphide through for 10 to 15 minutes to make sure of this. The sulphide is filtered off and washed with H_2S water. The precipitate is rinsed

into beaker using a hot solution equal parts nitric and bromine water to cleanse filter paper. The solution is boiled with frequent additions of bromine to insure oxidation of sulphur and complete solution. The solution is then diluted somewhat if necessary with distilled water, made faintly alkaline with ammonia, barely acid with acetic, and titrated whilst hot with the lead acetate solution as above.

For the determination of molybdenum oxide and ammonia molybdate dissolve 1 gram molybdenic oxide (MoO_3) in as little ammonia as possible. When all is in solution, dilute to 100 c.c. with distilled water, measure off 10 or 15 c.c. with pipette, run into flask, dilute, make barely acid with acetic and titrate as above. Dissolve 1 gram ammonium molybdate in 50 c.c. distilled water, add few c.c. ammonia, dilute to 100 c.c., take aliquot part and titrate as above.

COAL MINING IN ALBERTA IN 1915

By JOHN T. STIRLING, Chief Inspector of Mines.

The output of lignite coal in Alberta during the year 1915 was 1,682,922 tons, the output of bituminous coal 1,626,237 tons, and the output of anthracite coal 125,732 tons; showing a reduction of 14,479 tons of lignite coal below that of the year 1914, 327,130 tons of bituminous coal and 45,170 tons of anthracite coal, making a total reduction of 386,788 tons below the output for the year 1914. The total output from the province during the year 1915 was 3,434,891 tons, while that of the year 1914 was 3,821,739 tons. There was 23,826 tons of coke and 83,190 tons of briquettes produced during the year 1915.

The output from the Crow's Nest Pass district was 919,383 tons, from Calgary 943,897 tons, Lethbridge 719,728 tons, and from the Edmonton district 851,883 tons. This shows a reduction in output below that of the year 1914 in the Crow's Nest Pass, Lethbridge and Edmonton districts, while the Calgary district shows an increase of 82,475 tons over that of the year 1914. This is due to the largely increased development in the lignite district in the Drumheller field and the bituminous district in the Brazeau field. 23,453 tons of bituminous coal were disposed of in British Columbia, 84,489 tons in Saskatchewan, 4,136 tons in Manitoba, 29,788 tons in United States and 1,355,693 tons in Alberta. 15,100 tons of lignite coal was sold in British Columbia, 601,913 tons in Saskatchewan, 60,421 tons in Manitoba, 3,406 tons in United States, and 752,278 tons in Alberta. 26,062 tons of anthracite coal was sold in other provinces, 853 tons to United States and 21,859 tons in Alberta.

There were employed underground during the year 4,493 men, and above ground 1,952. This shows a reduction of 1,625 men employed compared with the year 1914.

The number of tons mined per man for the year 1915 was 532 tons, while that of the year 1914 was 467 tons.

The number of mines in operation during the year was 280, which is an increase of 16 over the previous year. 58 mines were opened during the year, while 72 were abandoned.

During the year an Order-in-Council was passed providing amongst other things that after the first day of July, 1915, all plans required to be kept in accordance with the Mines Act must be of durable material and must be prepared by or under the supervision of a person holding a certificate as Mine Surveyor granted under the Mines Act.

The Canadian Coal & Coke Co., Ltd., operating a mine near Coalhurst introduced during the year the Addison portable electric lamp. There are between 80 and 100 of these lamps being used in this mine with considerable satisfaction.

There were 18 separate accidents causing the loss of 18 lives, 15 of which occurred underground and three above ground; 28 serious accidents occurred underground and five above ground, and 27 slight accidents occurred underground and six above ground.

7.17 tons of coal was mined per pound of explosives used in bituminous and anthracite fields, while 3.91 tons of lignite coal was mined per pound of explosives used. The average number of days worked per month in the province was 16.9.

There were 131 prosecutions instituted for contravention of the Mines Act, and convictions obtained in practically every instance.

Two Mine Rescue Stations have been installed during the year, one at Nordegg and one at Pocatontas, making a total in the province now of six stations and two cars. The Mine Rescue training has been pushed ahead vigorously during the year, although considerable difficulty is now being experienced in obtaining men to undergo this training owing to the number who have enlisted.

There was 306,461 tons of coal mined in the Crow's Nest Pass district per man killed in the mines, 359,864 tons per man killed in the Lethbridge district, 121,335 tons per man killed in the Edmonton district, and 157,316 tons per man killed in the Calgary district.

GRANBY CONSOLIDATED M. S. AND P. CO.

"The average daily shipments from our Hidden Creek mine, in British Columbia, to our Anyox smelter are 2,500 tons of ore, containing between two and three per cent. copper," said Mr. O. B. Smith, general superintendent of mines for the Granby company.

"As the season advances we are employing more men on construction work, so our mine employees now number about 400 and those at Anyox and the smelter around 600. The wage scale for miners is a minimum of \$3.50 per day, with bonuses of from 25 cents to 75 cents a shift, according to the monthly average settlement price for copper. The bonus begins when copper is above 16 cents and the highest bonus is paid when it passes 22 cents a pound.

"Our mines at Phoenix are shipping an average of 3,000 tons of ore daily to our Grand Forks smelter. The mine employees number 400 and the smelter hands around 200.

"Two minor shippers to our Anyox smelter are the company's lime and quartz quarries. The former is about 90 miles from the smelter and ships 100 tons daily for flux. The latter is about one mile from the smelter and furnishes 100 tons daily for converter linings. The quartz carries more than enough gold values to pay its own way.

"From our Mamie mine at Hadley, on Prince of Wales Island, Alaska, we are also shipping 20 tons daily to the Anyox smelter. Another property we own on the same island is shipping 40 tons of ore daily, which contains enough lime to make it a desirable flux. We shall begin shipments from our mine at Valdez, Alaska, as soon as transportation is available. Steamers are scarce just now. The weather last winter in south-western Alaska was the worst known for years. High winds, intense cold and heavy snowfall combined to make operations difficult and costly."—Grand Forks Gazette.

ANNUAL REPORTS NIPISSING MINES CO. AND NIPISSING MINING CO., 1915

President E. P. Earle, in his annual report to the shareholders of Nipissing Mines Co., says under date of March 6th, 1916:

The results obtained from the operation of our property during the year 1915 were gratifying, although, owing to conditions caused by the European war, the average price at which our silver was sold was only 50.06 cents per ounce, which is five and three-tenths cents less than was obtained during the previous year.

The fine silver production was 4,097,391.17 ounces, valued at \$2,222,256.29 gross. Net receipts were \$1,441,427.67. The production cost per ounce of silver was 19.06 cents, which is about three-quarters of a cent less than in the previous year. There was added to sur-

plus account \$183,484.73, the total surplus now being \$1,786,260.93. There was paid to shareholders during the year \$1,200,000.

The ore reserves contain nearly nine million ounces of silver and recent developments in the vicinity of shaft 73 and along the Cobalt Lake fault indicate the possibility of important additions to the reserves. The mines and mills are, as usual, in excellent condition and the present market price of silver, viz., about 57 cents per ounce, as well as its future prospects, indicate that the results of the company's future operations may be regarded as promising.

General Manager R. B. Watson reports on the operations of the Nipissing Mining Co. as follows:

Nipissing Shipments in 1915.

	Dry Tons.	Fine Ounces Silver.	Net Value.
Silver bullion.	212.2520	6,164,239.03	\$3,158,720.21
Residue.	326.1845	10,774.12	11,903.30
Concentrates.	34.9865	61,629.59	27,784.54
Total shipments	573.4230	6,236,642.74	\$3,198,408.05
Less custom ore included in above. . .	381.4890	1,612,684.96	816,944.68
Shipments of Nipissing Product.	191.9340	4,623,957.78	\$2,381,463.37

Nipissing Production in 1915.

	Ounces Silver.	Gross Value.	Net Value.
Shipments in 1915.	4,623,957.78	\$2,422,791.14	\$2,381,463.37
On hand at mine, Dec. 31st, 1915. . .	583,705.54	332,712.16	325,497.47
	5,207,663.32	\$2,755,503.30	\$2,706,960.84
On hand at mine, Dec. 31st, 1914. . .	1,110,272.15	538,481.99	523,913.03
	4,097,391.17	\$2,217,021.31	\$2,183,047.81
Difference between estimated shipments in 1914 and actual returns.		5,234.98	5,231.10
Nipissing production	4,097,391.17	\$2,222,256.29	\$2,188,278.91

Cost of Producing Silver.

(Based on production of 4,097,391.47 ounces and 77,904 tons milled.)

		Per Ton Ore.	Per Oz. Silver.
Hydraulicking.	\$ 41,300.81	\$.530	\$.0101
Diamond drilling	1,299.34	.017	.0003
Development and exploration	119,283.00	1.531	.0291
Stopping.	102,346.58	1.314	.0250
Assaying and engineering	8,778.02	.113	.0021
Administration and office	27,505.90	.353	.0067
Boarding house and camp maintenance. . .	8,517.79	.109	.0021
Insurance and taxes	25,543.71	.328	.0062
General and legal	16,306.36	.209	.0040
High grade mill	50,290.65	.646	.0123
Low grade mill	302,019.01	3.877	.0737
Depreciation.	60,764.14	.780	.0148
Marketing product	38,796.59	.498	.0095
Corporation, New York office and traveling. .	12,252.76	.157	.0030
	\$815,004.66	\$10.462	\$1.989
Less rents and interest.	34,176.04	.439	.0083
Total cost of production.	\$780,828.62	\$10.023	\$1.906
Gross value of production.	\$2,222,256.29		

The only change made during the year in the high grade ore treatment is an important improvement in the **retorting of the large amount of amalgam** produced. This amalgam is now retorted and melted to bullion in one heat in large graphite crucibles mounted in tilting furnaces. The mill treated 921 tons of Nipissing ore averaging 2,474 ounces per ton and 553 tons of custom ore with an average assay of 2,917 ounces per ton. The refinery also treated the product from the low grade mill containing over two million ounces. Total shipments of bullion amounted to 6,164,239.03 ounces. The market for cobalt residue was poor on account of the war; the shipments amounted to only 326 tons.

	Dry Tons.	Assay Ozs.	Silver Ozs.
Ore treated	77,071	29.62	2,282,614
By-products treated	112	1322.34	148,036
	77,183	31.49	2,430,650
Bullion recovered from above.....			2,127,372
Extraction.....			87.52%

In the low grade mill there was treated 77,183 tons ore and by-products as follows:

Forty stamps ran 293.67 days or 80.45 per cent. of possible running time. The stamp mill has a larger capacity than the cyanide plant and is not run full time. Crushed per day 262.82 tons; crushed per stamp per day 6.57 tons. The mill was shut down during part of the months of February, March and April on account of shortage of power. Notwithstanding an increase of 20 cents per ton in the cost of supplies, the

total cost of treatment was reduced 7 cents per ton. The Callow screens in the tube mill circuits collected metallies which contained 176,158 ounces of silver. This removal of the metallic silver from the pulp did not improve the extraction or the cost in the cyanide plant and the practice was therefore discontinued.

The present high war cost of aluminum dust will make it necessary to substitute some other method of precipitation when our present contract for dust expires. Experiments on a large scale are now being carried on with the **use of sodium sulphide as a precipitant**, the resulting silver sulphide being desulphurized by the use of aluminum ingots in a caustic soda solution, before being melted down to bullion. The results

so far are satisfactory and it is likely that this procedure will be adopted.

During the past year a great deal of research work has been done to determine whether the tailings or ore can be treated to advantage by the oil flotation process. From these experiments it appears that a small additional saving can probably be made by using flotation and a small plant of four cells is now being installed to try out the process on a working scale.

Treatment Costs on Low Grade Ore.

Including Transportation, Picking Plant and Low Grade Mill
(Based on 77,183 Tons Milled)

	Total Cost.	Cost per Ton.
Crushing at mine	\$12,045.32	\$.156
Aerial tramway	4,967.85	.064
Surface tramway	4,594.49	.060
Picking plant	14,177.88	.184
Crushing and conveying	3,919.48	.051
Battery.....	22,787.60	.295
Tube mills and classifiers	50,091.80	.649
Desulphurizing and slime collecting.....	14,659.00	.190
Intermediate filtering	6,520.74	.084
Cyanide treatment	99,918.02	1.295
Cyanide filter	9,742.94	.126
Clarifying and precipitation.....	29,159.72	.378
Refining.....	7,959.01	.103
Heating.....	8,477.35	.110
Water supply.....	2,864.24	.037
Construction.....	1,326.89	.017
Residue dam.....	4,806.68	.062
Consulting.....	4,000.00	.052
	\$302,019.01	\$3.913

Consumption of Supplies at Low Grade Mill.

	Total lbs.	Cost per lb.	Total Cost.	Pounds per Ton.	Cost per Ton.
Sodium cyanide	329,600	\$.2240	\$73,813.22	4,270	\$.9564
Lime.....	378,680	.0040	1,523.41	4.905	.0198
Caustic soda	213,144	.0284	6,060.28	2,760	.0785
Aluminum dust	51,040	.4210	21,489.30	.660	.2784
Aluminum plates	8,140	.2364	1,924.30	.106	.0249
Aluminum ingots	4,257	.2104	905.83	.055	.0117
Pebbles.....	400,675	.0090	3,594.76	5.190	.0466
Coal.....	2,102,000	.0029	6,079.33	27.234	.0788
Borax.....	6,305	.0456	287.78	.086	.0037
Power K. W. H.....	4,922,400	.0117	57,704.41	63.776	.7476
			\$173,382.62		\$2.2464

Surface Prospecting.—The hydraulic plant began operations on April 23rd and continued until stopped by weather conditions on November 23rd. The main area washed lies to the east of Cart lake and to the south of Peterson lake. Acres washed, 111; cost per acre, \$372.08; cubic yards removed, 445,653; average depth of soil, 2.49 feet; cost per cubic yard, 9.27c., made up of: labor 4.83c., power 3.98c., and supplies .46c.; 184 set-ups were made; 31,053 feet of 16-inch pipe was laid down and 31,942 feet taken up; 12,657 feet of roads built; average pressure at nozzle, 136 pounds; pump ran 71.9 per cent. of possible running time.

The conglomerate flat on the east side of Cart lake was considered a very promising section, but the results were disappointing. A considerable area of diabase was also washed, but this formation is too rough to give good results by this method of prospecting. Pits or open cuts were made on twenty-seven different veins uncovered by the hydraulic operations; veins H.55 and H.63 produced a small tonnage of high grade ore and the work developed some mill ore, but none of the veins proved to be of much importance.

Geological investigation indicated an increased depth of conglomerate along the eastern side of this lot due to a faulting in the formation and subsequent diamond drilling has proved that the conglomerate continues to a depth 150 feet below the fourth level over a considerable territory. This development is of much importance, as it opens up a wide field for exploration under the most favorable conditions.

Vein 490 which occurs within this area was developed on and above the fourth level without success; it was a large vein but consistently low grade. A winze was then sunk on the vein and at a depth of 75 feet came into six inches of high grade ore. This good ore did not persist, however, but the winze was continued to a depth of 150 feet where the new fifth level will be started. The vein is badly broken up by faults, but it is confidently expected that a good ore shoot will be developed between these two levels.

While no new veins of much importance were discovered in the workings from 73 shaft, the old veins turned out well, so that the ore reserves show only a

Summary of Underground Work, 1915.

Shaft No.	Drifting (ft.)	Crosscutting (ft.)	Raising (ft.)	Sinking (ft.)	Stoping (cu. yds.)
14 O'Brien . . . . .	....	499.0	....	....	....
63.	316.0	521.5	53.0	....	2,356
64.	171.0	673.0	....	37.0	....
73.	1,520.0	3,202.0	744.0	136.5	15,154
80.	172.0	757.0	86.5	....	106
81. . . . .	....	....	....	6.0	....
96.	248.0	280.0	85.0	28.0	551
150.	139.5	676.5	105.5	....	....
H. Veins 55 and 63. . . . .	....	....	....	39.0	365
Total.	2,566.5	6,609.0	1,074.0	246.5	18,532
Diamond drilling (all underground at 80 shaft), 503 feet.					

Development.—The total of 10,496 feet of development compares with 12,148 feet done during the previous year. The stoping was also less, but this was largely because the stopes were full of ore; they now contain 72,200 tons ready to hoist.

Shaft 14 O'Brien.—Nipissing lot 402 lying north of the O'Brien mine is now being explored by crosscuts running east and west along the boundary between this lot and the O'Brien, the expense being divided by the two companies. Some 500 feet of crosscuts were driven in conglomerate without any favorable results; the work will be continued.

Shaft 63.—The Little Silver veins were developed through this shaft and proved much better than expected; the stopes are now full of ore and there is some further ore to break down. After a steady production throughout the year the reserves are higher than a year ago and amount to 675,000 ounces.

Shaft 64.—No work was done on the main 64 vein during the year and the reserves remain as before.

A crosscut is being driven north from the second level to explore the large section of conglomerate lying between vein 64 and the Bucke Township line; it has reached a length of 600 feet. A similar crosscut 800 feet to the east is advancing north from the fourth level of shaft 73.

Shaft 73.—The workings from this shaft continue to produce the larger part of the ore sent to the mill. The main stoping was on vein 98 and its numerous branches, which proved fully as good as expected.

small decrease. The high grade ore is estimated to contain 2,743,190 ounces, and the low grade ore 1,827,950 ounces.

Shaft 80.—Considerable crosscutting was done from the second level of 80 shaft without striking any veins of importance. The faulted extension of one of the old veins is being stoped with good results. The broken ore in the stopes on 80 vein was drawn on rather heavily during the year, which reduced the reserves to 525,000 ounces. No ore was taken from 100 vein; the reserves are estimated at 894,000 ounces.

Vein 96.—This vein lies south of the Little Silver and is developed by a tunnel. Another small ore shoot was found on 96 vein and a crosscut to the east cut vein 102. This vein was low grade at the outcrop, but on the tunnel level the ore averaged 4,000 ounces over a width of 1.5-inch for 95 feet in length. A winze is now being sunk on this orebody which is expected to produce well above and below the tunnel level.

Shaft 150.—Further underground exploration was carried on in the conglomerate to the east of Cart lake with continued poor results, so it was decided to shut down work permanently in this shaft.

Cobalt Lake Fault.—The exploration of this fault in Cobalt Lake ground has shown up several bodies of rich ore, the last one being found below the 450-foot level. The fault enters Nipissing ground on the dip and two of these ore shoots have extended to within a few feet of the boundary. Considering the great dis-

tance which this fault can be prospected on our property, it was decided to sink 81 shaft down to the contact and from this to thoroughly explore the fault on our side of the line; the prospects of finding ore are good.

cents per ounce of silver. The gross value of the production was \$2,222,256, and the total cost of production including every expense was \$780,828, leaving a net operating revenue of \$1,441,428. Dividends declared during the year amounted to \$1,220,000.

Nipissing Ore Reserves, December 31st, 1915.

(Developed and Partly Developed Ore.)

Shaft No.	High Grade Ore.		Mill Ore.		
	Tons.	Ounces.	Tons.	Assay.	Ounces.
64.	203.1	200,403	4,049	20	80,980
73.	1,621.2	2,743,190	73,118	25	1,827,950
80.	179.9	385,250	5,570	25	139,250
100.	260.4	609,400	11,391	25	284,800
63.	195.5	469,900	8,425	24.3	204,770
96.	51.9	148,300	2,263	25	56,575
	<u>2,512.0</u>	<u>4,556,443</u>	<u>104,816</u>	<u>24.7</u>	<u>2,594,325</u>
Dumps.			75,420	23.5	1,770,950
			<u>180,236</u>	<u>24.2</u>	<u>4,365,275</u>

Summary.

	Tons.	Assay.	Ounces.
High grade ore.....	2,512	1814.0	4,556,443
Mill ore	180,236	24.2	4,365,275
<u>Total.</u>	<u>182,748</u>	<u>48.8</u>	<u>8,921,718</u>

Summary of Results.—The past year has been one of uncertainty, both as to the price we were likely to receive for our product and as to the cost of supplies necessary to carry on the business. Under these conditions no effort was made to push the production of the mine beyond the tonnage necessary to yield the regular dividends. The price of silver was steady during the first part of the year between 48 and 50 cents; but in August it went down to the low price of 46½ cents per ounce in New York. In November and December there was a decided improvement in the market, the closing quotation for the year being 55 cents per ounce; since then it has ruled even higher. The average price received in London for Nipissing silver sold during the year was 50.06 cents.

The production for the year was 4,097,391 ounces of silver, compared with 4,689,333 ounces produced during the previous year. Costs were reduced from \$11.60 to \$10.02 per ton of ore and from 19.80 cents to 19.06

Some further development was carried out on the Teck-Hughes mine in the Kirkland Lake district, but the results obtained did not warrant the company in going any further under the terms of the option. The company had several engineers in the field who examined numerous properties, and some development work was done on a prospect in California, but no permanent interests were acquired.

The Nipissing mine has never shown ore reserves commensurate with its annual output, but the history of the company during the past twelve years has shown that the development of new ore has kept pace with the current production. As the property becomes better explored year after year, this result cannot be expected to continue indefinitely. However, with the possibilities at greater depth in the vicinity of shaft 73 and along the Cobalt Lake fault and with known ore reserves of nearly nine million ounces, satisfactory results are assured for a considerable period of time to come.

The report of the treasurer of the Nipissing Mining Co. is as follows:

Statement of Operations—Year Ended December 31st, 1915.

Gross settlements 1914 ore (paid for in 1915).....	\$ 596,292.57
Gross settlements 1915 ore	2,639,894.96
Gross settlements for year.....	\$3,236,187.53
Gross value of ore and bullion at mines and in transit, December 31st, 1911.	944,931.51
	<u>\$4,181,119.04</u>
Less:	
Gross value of custom ore purchased.....	\$ 829,323.17
Gross value of inventory, December 31st, 1914..	1,129,539.58
	<u>1,958,862.75</u>
Gross value of 1915 ore.....	\$2,222,256.29

Other Receipts:

Ground rents	\$19,937.00	
Interest, discount, etc.....	14,239.04	
		<u>34,176.04</u>
		\$2,256,432.33
Cost of mining and all other expenses (including smelter deductions, treatment, etc., on settlements 1915 ore and accrued charges on ore and bullion at mine and in transit).....		<u>815,004.66</u>
Net receipts for 1915 production.....	\$1,441,427.67	
Cost of special investigations and work on outside properties...	37,942.94	
		<u>\$1,403,484.73</u>
Surplus, January 1st, 1915.....	1,602,776.20	
		<u>\$3,006,260.93</u>
Less:		
Dividends declared and paid during 1915.....	\$920,000.00	
Dividend payable January, 1916.....	300,000.00	
		<u>1,220,000.00</u>
Net surplus to Balance Sheet.....		\$1,786,260.93

This net surplus is made up as follows:

Cash in various banks.....	\$776,854.17	
Ore and bullion at mine and in transit.....	944,931.51	
Accounts receivable	2,038.21	
Investments.....	33,430.00	
Deferred charges	6,000.00	
Mining plant, equipment and supplies.....	439,974.49	
		<u>\$2,203,228.38</u>
Less:		
Accrued expenses on ore and bullion not settled for.....	\$ 13,057.83	
Accounts payable (including estimated taxes)	103,909.62	
Dividend payable, January, 1916....	300,000.00	
		<u>416,967.45</u>
Net surplus.....		\$1,786,260.93

Balance Sheet, December 31st, 1915.

Assets.

Mining property	\$250,000.00
Mining plant, equipment and supplies	439,974.49
Investments.....	33,430.00
Deferred charges	6,000.00
Ore and bullion at mine and in transit.....	944,931.51
Accounts receivable	2,038.21
Cash in banks, New York, Toronto and Cobalt.....	776,854.17
	<u>\$2,453,228.38</u>

Liabilities.

Capital stock	\$250,000.00
Accounts payable, including estimated taxes.....	103,909.62
Accrued expenses on ore and bullion.....	13,057.83
Dividend payable January, 1916.....	300,000.00
Surplus (see Statement of Operations).....	<u>1,786,260.93</u>
	\$2,453,228.38

The Nipissing Mines Co. is incorporated under the laws of the State of Maine, with authorized and issued capital, \$6,000,000 in 1,200,000 shares of the par value of \$5.00.

The officers are: E. P. Earle, president, Richard T. Greene, secretary, and P. C. Pfeiffer, treasurer.

The directors are: W. H. Brouse, Toronto; E. P. Earle, New York; David Fasken, Toronto; John L. Feeny, New York; Richard T. Greene, New York; Denis Murphy, Ottawa; August Heckscher, New York, and R. B. Watson, New York. The late Mr. Duncan Coulson was a director.

PERSONAL AND GENERAL

Mr. T. F. Sutherland, chief inspector of mines for Ontario, will go to New Caledonia with Dr. W. G. Miller to examine nickel deposits there.

Mr. S. W. Cohen has gone to California.

Mr. C. L. Campbell is developing a molybdenite property near Amos, about 200 miles east of Cochrane.

Mr. Chas. O'Connell, manager of the Tough-Oakes mines, has returned to the property after spending some months in California. His health is much improved.

Mr. Clifford E. Smith is at Porcupine in charge of development work at the Ankerite claims, which are under option to Coniagas.

Mr. J. H. Stovel, recently appointed inspector of mines for the Sudbury district, has moved from Bruce Mines to Sudbury.

Mr. A. H. Brown, manager of the Hudson Bay and Dome Lake mines, has resigned.

Mr. T. W. Gibson, now in England, is expected to return to Toronto in a few weeks.

Dr. W. G. Miller, now in England, will go to New Caledonia to examine nickel deposits there.

Capt. H. H. Yuill is "Assistant Controller of Mines" with the first army in France.

Capt. G. C. Riley's brigade is now in France.

Capt. Angus W. Davis is in command of a tunnelling company in France.

Lieut. Eric Billington and Lieut. G. G. Gibbins were wounded while taking to pieces an unexploded German shell for the purpose of learning the construction of the detonator. Lieut. Billington's injuries were serious. Both are recovering.

Mr. John P. Keane, of Rosebery, Slocan Lake, B.C., where he runs a concentrating plant treating custom lead-zinc ores, was in Spokane, Washington, attending the Northwest Mining Men's Convention, held in that city during the latter part of March.

Mr. E. J. Montgomery, of Rossland, B.C., assistant superintendent of the Consolidated Mining and Smelting Co.'s Centre Star group of mines, was a recent visitor at Spokane, Washington.

Mr. O. B. Smith, of Vancouver, B.C., superintendent of mines for the Granby Consolidated Mining, Smelting & Power Co., lately paid one of his periodical visits to the company's big copper mines at Phoenix, Boundary district.

Mr. George T. Coffey, superintendent of hydraulic operations, Yukon Gold Co., has returned to Dawson from Oakland, California. Mr. E. E. McCarthy, the company's dredge superintendent, was in San Francisco during the latter part of March, on his return journey from New York to the Yukon.

Mr. Frank A. Ross, consulting engineer, Spokane, Washington, who prior to the sale of the property to the

organizers of the Hedley Gold Mining Co., was general manager for the Marcus Daly Estate, of the Nickel Plate group of gold mines and 40 stamp mill in Camp Hedley, Similkameen, B.C., has been appointed the Washington State representative on the United States Naval Consulting Board.

Mr. Charles Hayden, of the house of Hayden, Stone & Co., is to be the guest of D. C. Jackling in an excursion upon the latter's yacht, whose itinerary will take in both the Atlantic and Pacific sides of South America as well as a visit to the Republic of Bolivia. An excursion of that distance is unusual, although Commodore E. C. Benedict has made several voyages to South America and up the Amazon, having in view the possibilities of the rubber market.

GRANBY.

Granby Consolidated should treat approximately 1,000,000 tons of ore at its Anyox smelter during the coming year. Assuming a recovery of not better than 35 pounds of copper per ton of ore, the yield from that plant should approximate 35,000,000 pounds in addition to which the Grand Forks smelter should turn out 15,000,000 pounds, making a total of 50,000,000.

During the coming summer the Midas mine in Alaska, owned by Granby, is expected to start shipments. This ore will be treated in the Hidden Creek smelter at Anyox.

The usual winter interference with operations has about ceased. The agglomerator will start permanent operations just as soon as normal water power can be secured. This will also permit the entire four furnaces of the Hidden Creek smelter to run full blast. With the agglomerator the management expects four pounds of copper per ton of flue dust to be secured at a very low cost.

Although paying but \$6 dividends, Granby has been earning very much more. Assuming a cost of 10 1-2 cents a pound the company on 20-cent copper can show profits of \$4,750,000 per annum, on an output of 50,000,000 pounds. On a production of but 40,000,000 pounds profits would approximate \$3,800,000. The latter figure is equal to \$25 per share.—Boston News Bureau.

SULLIVAN MACHINERY CO.

A New England industrial which has profited measurably from the extraordinary activity in the American mining industry is the Sullivan Machinery Co. The company manufactures mining and quarrying machinery. Net earnings for the 1915 year were not far from \$540,000, or about 14 per cent. on the \$3,846,800 stock. The significant fact about these figures is that the bulk of the earnings accrued in the last four months of the year; in the first half profits were very small.

Sullivan Machinery has advanced to about \$130 a share from a price in the low nineties last year. Before the war it was an 8 per cent. stock. In the fall of 1914 the rate was cut to 4 per cent., and recently again elevated to 6 per cent. A satisfactory amount of unfilled orders was carried over to the new year, and it is believed to be only a question of a few months when the 8 per cent. dividend will have been restored.

The Western Dominion Collieries, Ltd., of Taylorton, Sask., have awarded a contract to the Roberts and Schaefer Co., engineers and contractors, Chicago, for the installation at Taylorton of a coal mining tippie using a horizontal screen.

A MOUNTED HAMMER DRILL FOR DRIFTING WITH PNEUMATIC FEED

By Frederick W. Copeland.

A tantalizing ambition of modern drill designers has been to develop a practical drifting machine, operated by air feed. The elimination of the shell and feed screw form of mounting in the modern stoping drill and the substitution for these parts of the air feed cylinder and piston, resulted in a great increase in drilling speed in all upper hole work. Air feed stopers, in spite of the fact that a striking plug or anvil is employed, secure high speed, because of the fact that the air feed holds the bit constantly against the rock, so that any break in its character is instantaneously followed up by the steady push of the air. In the case of the screw feed, the operator, if using a hammer type of drill, must catch the sound of the hammer as it strikes the front head; and take up the slack with the crank before the drill can work again at full load.

Effort has been made by means of what is known as the "Reverse Feed" cylinder to adapt the stoping drill to drifting work. This has been only partially successful; as a temporary expedient in work of short duration or in certain kinds of development, the reverse feed stoper has proven valuable. One difficulty encountered by it is the fact that the rate of feed cannot be varied, as it can with the feed screw machine. If the cutting is soft or uneven, a heavy feed stoper will drive forward as the resistance decreases and bind the bit. This means freeing the steel by hand, with great loss of time and effort on the part of the runner. If the reverse feed stoper is fitted with a light feed, to handle soft cutting in ore, no impression will be made when rock is encountered. Another objection is that the length of the stoper, when arranged for drifting, makes it clumsy to operate in cramped quarters and impossible to dip for cut holes, as the long feed cylinder strikes the roof.

The problem of eliminating the feed screw and crank with its attendant reduction in drilling speed, loss of time in moving about the drill, changing steel, etc., has at last been solved, however, and the solution is embodied by the Sullivan Machinery Co. in a new type of mounting for its automatically-rotating, hand-feed hammer drill. The idea for this mounting came from the southeast Missouri lead district, where a home-made affair, used for mounting hammer drills for drifting work, in the disseminated lead ore formation, showed great promise.

The perfected mounting, which has now been on the market for a number of months, consists of a feed cylinder and piston, similar to the reverse feed type employed for mounting stopers. Instead of one port leading to the back end of the cylinder, to drive the feed piston, and with it, the drill, forward against the work, two ports in the piston rod are employed, one conducting the air to the rear end of the feed cylinder and one to a point just forward of the feed piston. By this means, the first great advantage of this feed mounting is secured, namely, the drill is not only advanced to its work by air power, but is withdrawn from it by the same means.

At the will of the operator, air can be admitted to the rear of the feed cylinder only, to carry the drill

forward against its work; to the front end of the cylinder only, to carry the drill and steel back from its work; or to both sides of the feed piston at once, in which case a forward feed of modified strength is secured. The drill may be operated so that the steel continues cutting and rotating with the air feed acting in any one of these three positions. The feed may thus be regulated to suit the character of the ground being



Sullivan "DP-33" Water Tube Rotator in use on pneumatic feed and "U-20" Column for drifting

drilled, and when spotting a hole, crossing a slip, or cutting through a bug hole or mud pocket, the operator can so manipulate the action of the drill as to prevent its becoming stuck and to use just the right kind of blow in order to get the best and most rapid results. These changes of operation are all controlled by a common throttle valve, which admits air to both ports of the feed, and to the drill, as well, as required. This throttle can be operated from in front of the drill, if desired, or at either side. The runner does not have to stand behind his machine in order to operate it, but, if he wishes, can stand in front, with both hands directing the steel after the throttle has been set in the desired position. A supplementary throttle or hand wheel just inside the main throttle controls the rate of feed, as described above. When in one position, the full feed is effective for forward work against hard

rock or on holes pointing upward. In the second position, the differential feed is employed, securing a retarded rate of feeding, for down holes or soft rock.

A second scheme of controlling the feed is provided in a mechanical brake or retarder, controlled by a hand wheel, and placed at the forward end of the feed cylinder. This consists of a brake band surrounded by a coiled spring, which is tightened or released, as desired, by a hand wheel controlling a worm and gear. This retarder enables the runner to lock the feed piston in any desired position and to vary the strength of the feed still more than is possible by means of the supplementary throttle.

The writer has operated this machine in mines in northern New York, New Jersey, Wisconsin and Colorado, and has seen the pneumatic feed in operation in a great variety of conditions—in hard and soft drilling, in even ground and in ground full of seams and bug holes. By manipulating the supplementary throttle valve and the hand brake, the runner can adapt the feed to any kind of cutting, and with a little care and practice, can drill through any slips or pockets by working his brake and reverse to keep the bit free. With a light brake and reverse feed, he can cut his way out of any difficult ground, in which a feed screw would wedge the bit solid.

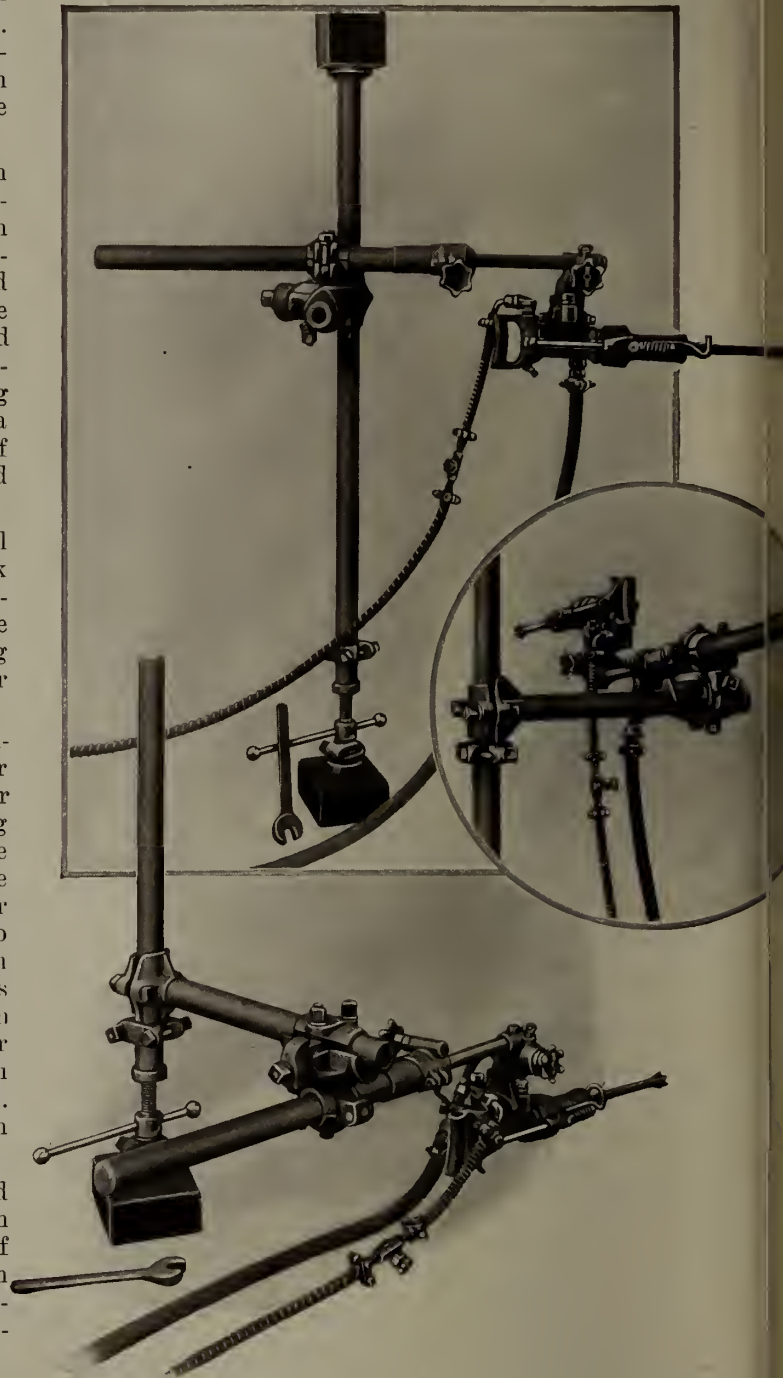
The reverse feed pulls the drill back with the steel instantaneously, saving the time lost in cranking back a feed screw machine and the labor expended in pulling back a stopping drill used as a drifter. The complete operation of pulling back, changing steels and running up to the face with a fresh steel, should not take over thirty seconds.

The drill feed cylinder is supported in a cradle trunnion which fits a standard saddle for a column arm or tripod. By shifting the position of the feed cylinder in the trunnion, back or forward, steels of varying lengths can be employed; in combination with the two-foot run of the feed piston, this makes it possible to accommodate a variation in lengths of steels of four feet; for instance, to change from a two-foot starter to a six-foot second, the starter should be run in with the feed cylinder pulled forward until only its end is clamped in the cradle. With the starter withdrawn from the hole and the feed piston in its extreme rear position, the feed cylinder may be slid back through the cradle until it is clamped close to the forward end. The six-foot steel can now be inserted and run down to its full depth, by reversing this operation.

By the above method, the runner can handle a round in an irregular heading without changing the position of the column. The most interesting use, however, of this change of position of the feed cylinder occurs in slicing, when the reach of the machine may be extended to take in a greater number of rounds, without sacrificing any of the length of the previous steel.

Method of Mounting.—If the air feed, with its practically automatic forward and reverse action, constitutes a remarkable improvement, the method of mounting the drill is no less remarkable. The drill is attached to a saddle, which forms the end of an offset arm, about 9 inches in length. The common air inlet and throttle valve for both the drill and the pneumatic feed is situated in this arm. To mount the drill on the feed, it is merely necessary to remove the throttle valve that goes with the machine when used for hand drilling, and place the valve chest of the drill in the saddle.

By tightening three clamp bolts, the rotator is converted from a sinking or block-holing tool, into a mounted drifter. This offset arm, swinging slightly as it does on the feed piston and cylinder, enables the drill to follow the steel, keeping always in line with it, so that the steel may work itself free without bind-



Sullivan Water Tube Rotator on "D-62" Pneumatic Feed and "U-20" Column. Various positions of the drill and mounting for work of different kinds.

ing, as is so frequently the case on a rigid feed screw mounting. To change steel with this rig, it is merely necessary to stop the machine by turning off the air, loosen the steel retainer with one hand, pull the drill chuck back off the steel, swing it to one side on the offset arm and pull out the used bit. By tightening up

the hand brake, the offset arm may be held in any desired position while changing steels.

A handy feature of the pneumatic mounting, provided by this offset arm, consists in the fact that holes may be drilled with the arm above the feed piston, and then, by swinging the arm and drill under the piston, other holes may be drilled without touching a nut or bolt of the mounting. By this swinging action, two holes 18 inches apart may be put in very rapidly. The use of reasonable judgment and forethought on the part of the drill runner will enable him to space out his round in such a way as to take one hole with the drill over the feed piston and the next with the feed below, so that he can get the round in in half the number of moves that were necessary with the feed screw mounting. A drift 8 x 7 feet in size can be handled from one set-up of the column, by employing an arm of suitable length.

Another advantage in the offset arm, not mentioned above, is the fact that, by its use, holes may be put in at practically any point in the face, including close to the wall, roof or floor of the working. By shifting the position of the drill in the saddle and cradle, holes can be put in at any desired angle. The drilling of cut holes in small drifts is easily accomplished by setting the column a proper distance from the face and shifting the feed cylinder in the cradle, as the angle of the holes may require. The action of the air feed drifter is so rapid as to surprise those that have not seen it, and the variety of work which it can accomplish is equally remarkable.

The low vibration which falls on the drill and on the mounting, due to the air cushion provided by the air feed cylinder and piston, permits the use of a light column and arm, which are a great assistance in confined work and one-man drilling. The standard mounting used with this rig is a 2½-inch column, on which arms up to 36 inches in length can be used without undue vibration.

The absence of a crank and feed screw to operate, the absence of chuck bolts to tighten and loosen, and the reduction in the number of stuck steels, are items which reduce the amount of labor required and make the work of the drill runner lighter and more congenial. Once the drill is started, with the brake set for the proper feed, the operator is free to leave the drill until the run is completed. In the meantime, if he knows his work, he can pick out the next steels, measure them for length and gauge, blow them out and put them in position for a quick change; or, he can be squaring up a place for the next set-up of the column, or cutting his fuse and preparing his powder for shooting.

As suggested above, the pneumatic feed, in combination with the Sullivan rotator, makes a machine that is practically an all-around drilling tool. The drill itself weighs forty pounds, the pneumatic feed cylinder and piston, with offset arm, sixty-five pounds; so that the outfit can be handled readily by one man and carried by him into any part of the mine and there set up. When the round of holes in the drift is completed, if there is sinking or block-holing to be done, the loosening of three clamp bolts frees the drilling tool proper, and by substituting the regular throttle valve, the machine is ready for any kind of hand feed drilling work. A minute or two is sufficient to make this change. Should raising be required, or upper holes, the drill on its mounting can be removed from the

column arm, and the rear end of the feed piston, set against a rock or abutment. The drill then becomes an automatically rotating, water jet stopper, of the most efficient kind.

These features render the pneumatic feed mounted rotator a popular machine with leasers and mining companies beginning operations on a small scale. The same drill can be used for shaft sinking, cross-cutting and stopping, with minimum expense and delay.



Putting in a "lifter" with the drill under the feed piston.

The air feed, with offset arm; the light, improved hammer drill, with automatic rotation of steel; the steel retainer and water attachment combine in one drilling tool all of the improvements considered most valuable and advanced in rock drilling mechanism. In short, the pneumatic feed mounting, with the water tube rotator, forms a combination that is the last word in drill design. The mine operator welcomes it for its unexcelled daily footage and low repair and power cost per foot drilled; and the runner boosts for it as the easiest one-man drill to operate that is on the market.

STANDARD CHEMICAL IRON.

The Standard Chemical Iron and Lumber Company, Limited, is out with its 1915 report. This shows a complete reversal of form, as compared with 1914, in which latter year the business depression had a marked effect on the affairs of the company. Judging from the whole tenor of the present report, and taking into consideration the fact that prices of commodities have scored a distinct advance operations for the current fiscal year should net the largest returns in the company's history. For the year ended December 31st last, gross profits, including those of the subsidiary companies, amounted to \$301,859, as compared with \$21,509 the previous year.

TEN YEARS' MINING PROGRESS IN BRITISH COLUMBIA

The total value of the mineral production of British Columbia for all years to the end of 1915 has been \$516,122,000. More than one-half of this large value, about \$267,459,000, was the production of the last ten years. That is to say, the value of the production of the ten-year period, 1906-1915, was somewhat greater than that of the 54 previous years included in the official records.

A few weeks ago it was stated at a public meeting in Victoria that the production of the metalliferous mines of the province was \$15,000,000 in 1905 and \$15,000,000 in 1914, and that in the intervening ten years there had not been one dollar increase. That was a misstatement. As a matter of fact, the value of the metalliferous minerals produced during five years, 1906-1910, was \$70,133,000, or nearly \$16,000,000 a year, and during the last five years, 1911-1915, \$84,485,000, or nearly \$17,000,000 a year. The accompanying comparative table shows the quantities and value of the various minerals produced in British Columbia during the two five-year periods just mentioned, and exhibits the actual position, which is that during the last five-year period, as compared with the first similar period, there was an increase in quantities of gold, silver, lead, copper, zinc, coal, and miscellaneous products, and a decrease only in coke, while the increase in value of metalliferous minerals was \$1,070,298 a year, and of coal and coke together \$495,978 a year. And it should be remembered, as affecting the production of coal and coke that during the last five years there were labor strikes of longer duration in both of the big coal-producing areas of the province than in any other period in its history, leaving out of account the unfavorable effect of both the use of fuel oil and of the war.

Very briefly reviewing the position to-day of the mining industry, the following facts are evident. The outlook for increased production of placer-gold is more favorable than for several years, both for Cariboo district, now that railways are more accessible, and for Atlin, with its productive area being enlarged. More lode-gold will be produced in the near future from mines in Rossland, Boundary, and Similkameen districts, while in the Coast district (Surf Inlet, Anyox, and Omineca) there is also promise of an increase. Activity at Slocan and Ainsworth district mines, warrants the expectation of more silver being produced, while in less degree this metal will come more freely than in recent years from mines in districts where it occurs in association with other metals. Slocan and Ainsworth will also produce more lead, and East Kootenay will doubtless do the same, for with the bigger output of lead-zinc ore from the Sullivan mine, already arranged for, this is assured. The production of zinc will make substantial progress in the immediate future, for not only will there be a considerable quantity of this metal produced at the new zinc works at Trail, but, as well, several mining companies have made arrangements to ship much zinc ore and concentrate to the United States. As to copper—never before was the situation so favorable, for two or three large mines in the Coast district are now in a position to produce freely, while interior mines are maintaining their output. And the coal-mining companies, too, have prepared for a greatly enlarged production, new mines having been opened during the last year or two on Vancouver Island, while in the Crowsnest district immense coal areas, not heretofore worked, have been opened, ready for operation whenever the market for

coal shall make demands upon them. The greater activity at smelting works that is assured will involve the manufacture of more coke. It is of interest to note, in this connection, that one big company has obtained from its shareholders sanction to raise a large sum of money for saving by-products from coke-making.

The advances made and being made in metallurgy are significant. The electrolytic refining of lead has long been an established industry at Trail. Now preparations for producing refined zinc there are well forward, and it will not be long before copper will also be refined electrolytically there. A notable feature in economy at the Trail works is the successful adoption of a process for the electrical precipitation of metals contained in the fumes from the copper, lead, and zinc furnaces and roasters. The modern flotation process to increase the saving of metals in concentration of ores is in profitable use in Slocan district on lead-zinc ores and at Britannia Beach, on the Coast, on copper ores.

Transportation facilities have been, and are being improved, in various parts of the mining districts. The extension of railways, the construction of wagon-roads, and the installation of aerial and other tramways, all tend to reduce costs and thereby to make mining profitable.

Half a dozen or more of the companies operating metalliferous mines in British Columbia are now on a dividend-paying basis, making periodical distributions of profits among their shareholders, and quite recently the Crow's Nest Pass Coal Co. declared a dividend after an interval of four years, during which comparatively large liabilities were entirely discharged.

On the whole, then, it would appear that the Provincial Mineralogist is well warranted in using these words with which he concluded the recently-issued "Preliminary Review" for 1915: "Generally, it may be said that the outlook for the larger operating mining companies of British Columbia is more promising than at the beginning of several successive late years. There is a good demand for the metals they produce, prices subject to fluctuations are higher than at this time last year, operating conditions are favorable to a comparatively large production, and there is no present prospect of any set-back to interfere with the progress that it is now confidently expected will be made in 1916."

Comparative Table for Two Five-Year Periods.

Mineral.	Five Years, 1906-10.		Five Years, 1911-15.	
	Quantity.	Value.	Quantity.	Value.
Placer gold	*172,020	\$3,440,400	*140,075	\$2,801,500
Lode gold ..	*1,181,713	24,426,009	*1,249,915	25,835,742
Total gold.	*1,353,733	\$27,866,409	*1,389,990	\$28,637,242
Silver.	*13,350,082	7,406,914	*15,526,901	8,234,242
Lead.	†222,397,745	9,687,444	†223,723,948	8,740,656
Copper	†214,939,001	33,485,392	†237,759,685	36,202,033
Zinc.	†15,699,192	687,273	†36,435,867	2,670,280
Total value, metalliferous		\$79,133,432		\$84,484,924
Coal (after deduction of that made into coke)	†9,801,741	33,547,443	†10,316,980	36,109,430
Coke.	†1,146,271	6,678,399	†1,099,384	6,596,304
Miscellaneous products..		6,175,200		14,734,001
Total value of production.		\$125,534,474		\$141,924,659
*Oz. †Lb. ‡Long tons.				

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE, SWASTIKA

Dome.

The construction work at the Dome Mines has now reached a stage where the activity is at its height. The central shaft is almost completed and the foundation for the head frame and the hoist house are already in. Within a very short period it will be necessary to sink this shaft to the 800-ft. level as from that point the cross-cut is to be run towards the Dome Extension line, at the 800-ft. level. This cross-cut must be run into Dome Extension ground and it is from it that all work will be undertaken on the Dome Extension. The taking over of this option on the Dome Extension will entail a good deal more work on the Dome management. Excavations are also well under way for the secondary crushing plant. The first crushing of the ore will occur at the 600-ft. level in the big steel-jaw crusher. The second crushing will occur at the rock house which is being built half way between the new central shaft and the mill. Here a big and a small jaw crusher will be installed to break rock so that it will pass through a two and a half-inch trommel. A big gyratory crusher will be installed as an auxiliary. The ore will then go direct to the Hardinge mills and the stamps. One of these eight-foot Hardinge mills is now treating about 350 tons a day. When it was first installed the feed was crushed to 1½ inches, but in order to raise the tonnage it was raised to 2½ inches. Ten stamps have been removed to make room for the second Hardinge mill which should be back from Toronto any day. It was sent from the factory some weeks ago but was found to be out of line and was sent back at the owner's expense to be put into shape. There is no doubt that the management of the Dome intends to supersede stamps with Hardinge mills as occasion offers. The two tube mills are now installed and are now ready to run and the mill at the Dome should be crushing forty thousand tons a month by July. The production during the month of March was a record both in respect to production and of tonnage crushed. The grade of the ore was a little lower, but it can be regulated to suit the requirement of the management. The bulk of the ore is still coming from the big glory hole on the surface but the grade of the mill feed is raised from ore from development. Before satisfactory extraction can be made from the ore coming from the lower levels of the mine the present mill will have to be very radically altered. It is possible a new one will be built when the low grade ore from the upper levels is exhausted. The record for the first three months of the year at the Dome was as follows:

	Ore Milled.	Bullion Recovered.	Value Per ton.
January	31,600	\$176,990.00	\$5.58
February	32,040	163,500.00	5.10
March	34,300	173,380.00	5.05

The Dome is now seriously considering the comforts of its employees. The growth of the mine has greatly outdistanced the growth of the accommodations for the men and plans are now being drawn for a dormitory for the single men and blocks of double houses for the married. The dormitory will be one of the most comfortable and hygienic ever erected in the north country. There will be on the first floor a large rotunda, around which will be reading and writing

tables. Around this hall will be bed rooms, each man having his own bed and only two men in a room. The building will be of three stories and on each story a lavatory and a bath. For the married men a series of double houses are to be erected. Ten will be put up in the first block, but it is anticipated that forty will be set up in a very short time. To-day most of the men working at the Dome live in South Porcupine, a distance of a mile and a half. The accommodations in the dormitory will be for ninety-two men.

Mr. J. C. Houston has settled down as general superintendent of the Dome and is now attending to most of the details of the work of what is now becoming such a large organization. Mr. C. D. Kaeding is making good progress with the annual report.

Dome Extension.

The arrangement whereby the Dome agrees to take up the option on the Dome Extension has aroused a great deal of controversy. It appears to be a clear cut agreement upon which there should be little argument, and it should be for the benefit of both companies. The Dome takes an option on the total assets of the Dome Extension Mines for the sum of \$1,150,000 to be paid for by the issue of \$46,000 Dome shares. The option is open until October 15th, 1917. Under this option the Dome Mines must sink their shaft to a depth of 850 ft. and carry a drift at 80 ft. into the territory of the Dome Extension. It is provided that not less than an average of 100 ft. of drifting should be done on the Dome Extension every month and that not less than \$5,000 should be so spent. At the same time the Dome Extension may proceed with any work they may see fit as long as they do not interfere with the Dome development. The Dome Extension have full right to see and inspect all work carried on by the Dome and they will have access to the assay sheets of the Dome work at all times. The option will provide for the development of the Dome Extension for the next year and a half. It is believed by everyone in the camp that the orebody found on the big Dome dips into the Dome Extension at a depth of 1,200 ft. or thereabouts, and in this case the development of this part of the property should show some very valuable ore.

McIntyre.

Construction both underground and on the surface at the McIntyre group is very active. After considerable figuring it was finally decided to build a surface tramway between the No. 5 shaft of the McIntyre and the Jupiter shaft. This will entail a line of rails for three thousand feet around Pearl Lake. From No. 5 shaft the aerial tramway will be doubled to the McIntyre mill in order to carry the extra ore. At any time when the connection is made between the No. 5 shaft and the Jupiter ore can be taken out. Ore is broken in the stopes at the Jupiter at the 50, 100, 150 and 200 ft. levels and it can be broken at the 300 ft. level on a very short notice. The head frame and rock house on the Jupiter were long delayed by the non-delivery of material, but are now nearing completion. A careful sampling of the Jupiter ore is provided for in the rock house at the Jupiter before it leaves the mine. It will be broken to 2½ inches before it is loaded on the surface cars. Notice has been received by the McIntyre Company that the two vertical compressors ordered by the Jupiter Company a year

ago have at last been shipped. In the meantime the old compressor at the Jupiter will be used until the big machines arrive.

The new unit at the McIntyre mill is in full running order. Advantage was taken of the fact that Jupiter ore could not be delivered for some time, to shut down one of the existing units and clean it up. The enlarged mill is now treating about 370 tons a day of McIntyre ore, and last month about 10,000 tons were handled.

Copper and Molybdenite.

Copper and molybdenite are being mined by a Montreal syndicate along the Transcontinental Railway about 200 miles east of Cochrane. The copper prospect is to the north of the track near Spirit Lake. The molybdenite is coming from the orebody known to exist on Keewagama Lake which is a little south of the track.

The headquarters for these operations is at Amos. It is understood that a quantity of both copper and molybdenite has been assembled and may be shipped at any time. The demand for copper ore has caused a very keen search for that metal all over the north country. The Rand Syndicate have taken an option on two deposits in on Temagami Lake, one of them on Cedar Lake, and the other on Temagami Lake itself. One car has already been shipped, another has been assembled and another will soon be taken out. Previously not more than one or two cars of copper ore have ever left the north country.

Deloro.

The activity in Deloro continues to increase as the spring advances. The Porcupine Premier Mines, formerly the Old Standard, is now pumped out and two drills are running east and west on the 100 ft. level. Good results have been obtained in at least one drill hole by the La Rose on the Maidens-Macdonald property.

Mr. Clifford E. Smith is in Porcupine personally superintending the work on the Ankerite claims upon which the Coniagas Mines have taken an option. As soon as supplies can be taken in work will commence here and it is probable that diamond drilling will be undertaken. The most strenuous campaign is on the Chisholm Vet, where Mr. Thomas is running five diamond drills for the Chisholm Corporation Limited. With these drills an attempt is being made to fairly thoroughly gauge the possibilities of this property. Each drill is put down at an angle of 45 degrees to 1,000 ft.

Dome Lake.

Mr. A. H. Brown has resigned his position as manager for the Hudson Bay Mining Company. Since the old mine shut down at Cobalt, the Hudson Bay Mining Company have been largely interested in the Dome Lake and it is at this point that Mr. Brown has been located. The foundation for the new cyanide plant at the Dome Lake has been completed for some time and it is believed that the first ore will be treated about the end of this month. It is an entirely new process and the results will be watched with keen interest all through the district.

West Dome.

Mr. Trethewey has taken up his residence on the West Dome Consolidated. The old shaft has been dewatered and sampling is now in full progress. As soon as possible a diamond drill will be set up in the low-lying land between the West Dome Consolidated and the Dome Lake and several holes put down. There

is every indication that the company intends to carry on a vigorous campaign of development this summer.

Porcupine Crown.

The Porcupine Crown have let contracts for a system of exploration with the diamond drill on the 500-ft. level. Flat holes will be run at regular intervals in order to endeavor to give further ore bodies. The last month has been satisfactory at the Porcupine Crown inasmuch as production has been a good deal higher than it was.

COBALT, SOUTH LORRAIN, GOWGANDA

Flotation Processes at Cobalt.

More and more attention is being paid to flotation in the camp. The representatives of the General Engineering Company who hold the patent of the Cal-low Pneumatic Process believe that most of the old dumps in the camp will be well worth treating and there is a project to form a company to erect a plant to treat all these old dumps. Most of the existing companies in the camp are considering the advisability of putting in flotation to raise the extraction on the slimes. McKinley-Darragh and Buffalo already have these plants under construction.

The McKinley-Darragh is putting in two double-length roughing cells and two cleaner cells. They are also leaving room for two more cells if necessary. The present equipment will provide for treatment of 150 tons a day. The Buffalo is putting in a plant which will be capable of treating 600 tons a day of their tailings and also low grade ore they may take out of the mine. This plant will consist of eight 9-ft cleaner cells. Research so far leads to the conclusion that the higher extraction from flotation will lead to the treatment of lower grade mill ore than has heretofore been possible.

The fact that the experiment with the flotation plant is not at all expensive and the operating costs light, makes the experiment a very desirable one for the Cobalt camp. Concentration mills in the camp are still not making a much higher extraction than 80 per cent. and flotation will quite materially increase this. In existing mills the treatment will be over the sand tables as at present, but the slime tables will be taken out and flotation plant installed in their place.

Prospecting.

The advance in the price of silver is bringing to life many old prospects and some new ones. In Cane Township, near Elk Lake, several companies are working on veins in the diabase. These veins show considerable native silver and several mining companies are working on them. The Royal Mines, a newly formed Montreal Company, has installed a plant and is doing considerable work. On the McCrea claims work is also in progress. The Genessee Mining Company working a prospect in the conglomerate north of the Hudson Bay Mining Company is making good progress with the shaft. The barren calcite vein is growing wider and its silver content is increasing. At about 70 ft. it runs from 30 to 40 oz. in silver.

South Lorrain.

The Comfort Leasing and Mining Company on the Wettlaufer in South Lorrain is now in full operation. Drills are running and some high-grade has already been taken out.

The Belle Ellen Mining Company in South Lorrain is also making fairly good progress and obtaining satisfactory results.

Nipissing.

The Nipissing report for the month of March gives some interesting information as to progress north of the town. After some disappointment another shoot of ore has been struck on vein 490. This was discovered 112 ft. below the fourth level of the Meyer. The ore is not high grade, but there is every indication that good ore will be cut. Another level is to be sunk at shaft 80 from which the ground near the City of Cobalt boundary will be prospected. On their ground the City has had such remarkable success that it is believed most likely the Nipissing will find a good body of ore on their property. The shaft from which the Cobalt Lake fault will be developed on Nipissing, is now down to the 400-ft. level. The first drift will be run at 325 ft. and the second at 525 ft. As good ore has been found on the Cobalt Lake Fault at 450 ft. the Nipissing should soon reach a very interesting stage of development at this point. The production from the Nipissing for March was \$2,000 less than in February, but \$19,856 more was shipped in Nipissing and Customs bullion.

NOVA SCOTIA

Dominion Coal Production.

For the first quarter of the year the production of the Dominion Coal Company shows an increase of 253,000 tons compared with the first quarter of 1915. For probably the first time in the company's history, the coal mines have worked through the winter months as steadily as is the custom in the summer months, and although in many parts of Eastern Canada the winter was an unusually severe one, yet in Cape Breton the interruptions from snowstorms were very minor. That with an output capacity so seriously diminished by enlistments the Dominion Coal Company should have been able to show an increased production of over a quarter of a million tons of coal in the first quarter, is explainable by two conditions, namely that the first quarter of 1915 showed very much below the normal production, even of the winter period, and the quarter just elapsed has been one of continuous operation, although with a reduced number of workmen.

The outputs actually obtained compare with 1915 as follows:

First quarter:	1916.	1915.
Glace Bay Mines...	1,126,000	864,871 tons.
Springhill Mines...	100,000	98,791 tons.
	1,226,000	963,000 tons.
Increase		253,000 tons.

From the first of April onwards, however, the monthly outputs will not show anything like this rate of increase, but will probably show a decrease when compared with 1915, so that by the end of the summer of 1916 the production for the year to date will, from present indications, have fallen below the figures of last year. That is to say, the increased production at the end of March will have been replaced by a decreased tonnage figure, say by the end of September.

The financial year of the Dominion Coal Company ends at the 31st of March in each year. The revival of trade commenced to be felt about the month of April, 1915, so that the financial year 1915 of the Dominion Coal Company should compare very favorably with its predecessor, and will indeed be not only the best year for production since the merger of the Steel and Coal Companies in the Dominion Steel Corporation, but the best year in the Coal Company's history.

The demand for coal for railway use at the present time is quite striking, and it is, of course, a natural outcome of the general activity that all railroads in the United States and Canada are now experiencing. Some of this activity, probably more than is suspected, is the result of the greatly increased cost of water transportation, the effects of which are quickly felt in a country like Nova Scotia, where, because of the shape and geographical features of the country, rail freights have always been largely controlled by water freights. The Intercolonial Railway is particularly busy, and is being taxed beyond the capacity of the present rolling stock and engine power by the demands that are being made upon it for the conveyance of freight, plus the movement of military stores and troops. The great waterway of the St. Lawrence and the Great Lakes has always provided Canada with healthful competition between rail and water transportation, but the increase in shipping freights to-day affects equally the Great Lakes routes and ocean-borne trade. There seems no reason to anticipate any reduction in freight rates in the near future, and there are a good many reasons to anticipate a still further increase in the cost of water transportation. Shipping freights are absurdly high to-day, showing increases of over one thousand per cent. on the rates of normal times, but the tendency is upwards, and it may be that even the extraordinary rates of the present time will seem cheap in a year from now. Therefore it seems reasonable to expect a heavier demand for coal from the railways, coupled with large orders for locomotives and rolling stock. It may be that the net result when normal days come again will have been the general improvement of the railroads, and that the financially improved conditions of the roads will have enabled some elimination of bad grades and the necessary amount of double-tracking to enable full advantage to be taken of the present roads. Surely not for much longer will a single-track railroad from Montreal to Sydney suffice for the needs of the Province of Nova Scotia. However that may be, the present activity of the Intercolonial Railway means quite an appreciable increase to the demand for coal in Nova Scotia.

"In last year's report reference was made to the depressed condition of the iron and steel trade as experienced for the great part of that year, and which reached a crisis with the outbreak of the great war at the beginning of August and for two months following largely paralyzed the ordinary activities of the Company. It was only during the last few weeks of the calendar year 1914 that any improvement was manifested when certain munition work was undertaken and some two hundred thousand shrapnel shell bodies were produced at the New Glasgow plant. That report pointed out that when the year closed the Company had been entrusted with ordnance material orders sufficient to keep the plant fully occupied for the first six months of the present year.

"The additional forging presses and other plant requisites for the execution of the very considerable order then entrusted to the Company were installed as rapidly as possible. Equipment for the finishing and assembling of shrapnel shells was also then installed. This was followed in May by building and equipping of a second finishing department for machining and assembling 4.5 and sixty-pounders high explosive shells. For the calendar year 1915 there was manufactured in the Company's forges nearly three million of shell bodies, comprising four different sizes of shrapnel and high explosive shells. During the closing months of 1915 we contracted for a further large ton-

nage of shell forgings including larger sizes than have hitherto been made in the Dominion. To enable us to undertake this munition work it was decided to instal a further unit of larger and more powerful presses, for forging shells up to 19-inch diameter. Orders for the necessary presses, accumulators, pumps, boilers and other plant have been placed and the foundation for this machinery is now all in place. The buildings erected are practically completed, some other plant is already on the ground and the balance will be installed so soon as we can get a delivery, and it is expected that within a few weeks we will be turning out a considerable tonnage of large shells. To aid in providing the large additional quantity of steel required to fill the contracts referred to, your directors in November last decided on an additional sixty-ton open hearth furnace at Sydney Mines and this furnace was actually producing steel within four months from the date of that decision which, under existing conditions, we considered work. The iron and steel operations were considerably greater than in 1914, and were as follows: Coke made, 90,277 tons; limestone and dolomite quarried, 79,211 tons; pig iron made, 73,110 tons; steel ingots made at Sydney Mines, 97,072 tons; steel billets rolled at New Glasgow, 76,082 tons; total shipments of finished steel forgings from New Glasgow plants being 60,283 tons.

"Owing to the great shortage of suitable steamers for transportation, the abnormally high cost of shipping and shortage of skilled labor, due to enlistments, mining was not proceeded with as vigorously as in former years, the total coal mined being 618,103 tons, or 134,050 tons less than the previous year. Of this tonnage there was used in the manufacture of iron and steel and other plants of the Company 284,971 tons, or 110,323 tons more than the previous year. We supplied to the collieries' workmen 13,432 tons; sold in Newfoundland and Maritime Provinces slightly over 140,000 tons, while shipments to Montreal and other points on the St. Lawrence River were 125,000 tons, being only about 40 per cent. above the previous year. Our coal consumption has increased by reason of our larger operations and are likely to further increase during the current year. Therefore, the coal sales this year in the open market will be comparatively small. The coal royalty paid to the Nova Scotia Government for the year 1915 amounted to \$69,914. Owing to the depressed conditions of the iron and steel trade during the first half of 1915 and especially the great shortage of suitable shipping and exorbitant cost of freighting, but a comparatively small quantity was sold for delivery in the United Kingdom and no sales were made in the United States.

"The iron ore output was 125,069 tons, being the smallest output for many years and was nearly all used in the company's own operations. The royalty paid the Newfoundland Government during the year was \$14,253.22.

"Shipping freighting conditions during 1915 were abnormal by reason of the interruption of the regular business of the company due to the war and the large amount of new business arising out of the war."

BRITISH COLUMBIA

Several companies operating metalliferous mines in British Columbia recently declared **dividends**. The Consolidated Mining and Smelting Co.'s quarterly dividend, at the rate of ten per cent. per annum, totalled \$145,125. The Granby Consolidated Mining, Smelting

and Power Co.'s quarterly dividend at the rate of six per cent. per annum, amounted to \$224,979; the Hedley Gold Mining Co.'s quarterly dividend and bonus, together 5 per cent., totalled \$60,000; the Standard Silver-Lead Mining Co.'s next monthly dividend of \$50,000 payable on April 10.

From time to time opponents of the Provincial Government have alleged that there are Orientals working in coal mines on Vancouver Island who have not passed the examination for coal-miners prescribed under the Coal Mines Regulation Act, or who are not entitled to hold a coal miner's certificate under that Act. It has been announced that in order to meet such a situation, if the allegations be true, it is the intention of the Provincial Government to bring in a bill during the current session of the Legislative Assembly which will provide for re-examination of all Oriental miners working in the coal mines of the Province.

West Kootenay.

Slocan.—Mr. Bruce White, one of the discoverers of the property near Sandon for years known as the Slocan Star silver-lead mine, now manager of the Noonday Mining Co., was lately reported in the press to have said: "Since I first went to the Slocan country, in the autumn of 1892, I have never seen such severe weather as we have had during the winter now closing. It made both development work and production almost impossible, but despite this fact one result of the winter's work was to demonstrate that in at least two mines the veins and oreshoots persist to considerable depth. After having done much exploration work, the **Slocan Star** has opened a splendid body of ore on a level 1,000 ft. below the outcrop, while the **Noble Five**, in a new lower tunnel, has proved the persistence of its orebodies to a relatively lower horizon. There are indications that in the Payne mine the results of development work in the deep will also be similar."

Boundary.

From the Greenwood "Ledge" it is learned that Messrs. Houghton & Oliver, lessees of the Jewel-Denaro Company's Jewel gold mine, at Long Lake, eight miles from Greenwood, have nine men at work and have 1,500 tons of ore ready for being milled. It was intended before the end of March to increase the number of men to work in the mine and to resume operating the 15-stamp mill there.

Announcement has been made recently that it is expected a **second blast furnace will shortly be blown in at the British Columbia Copper Co.'s smelter** at Greenwood. On August 23, 1914, smelting operations were suspended at these works, owing to copper-marketing difficulties resulting from the war in Europe. On July 26, 1915, one of the three furnaces was blown in, the available supply of ore having been insufficient for larger operations being then undertaken. As the blowing-in of another furnace appears to be planned, it is to be inferred that more ore is now obtainable for reduction here. Dr. Alfred W. G. Wilson, in The Copper Smelting Industries of Canada (Mines Branch of the Canada Department of Mines, 1913, No. 209) states, on p. 127, that "there are three water-jacketed blast furnaces in the cupola building. Originally these furnaces were 340 by 240 in. at the tuyeres; the capacity was increased in 1910 about one-third by widening the two end furnaces to 51 in. and lengthening them to 360 in." The centre furnace was similarly widened. Mr. Frederic K. Brunton, in a paper pre-

pared for the San Francisco meeting of the American Institute of Mining Engineers held in September, 1915, an abstract of which paper was printed in the Canadian Mining Journal of July 15, 1915, pp. 440-43, stated that those enlargements increased the total smelting capacity of the three furnaces to 2,400 tons a day. In his introductory comments Mr. Brunton said that this smelting plant "is of special interest to metallurgists for several reasons. It was successfully smelting in blast furnaces the lowest grade copper ore of all plants in America. In order to do so, it had to be run at very high efficiency, which necessarily required a large tonnage per square foot of hearth area, together with the minimum amount of labor and other costs. The furnaces smelted daily 2,250 tons of ore (6.62 tons per square foot of hearth area), containing 0.85 per cent. of copper, at a smelting cost of \$1.18 a ton. The entire plant required 130 men to operate it and keep up repairs, showing a labor efficiency of about 17.5 tons per man per day."

General Notes.

The incorporation of the **Wild Horse Creek Placer Gold Mining Co., Ltd.**, with an authorized capital of \$100,000 in 1,000,000 shares, par value 10c each, has been gazetted. It is probable the scene of this company's operations will be on Wild Horse Creek, Fort Steele division of East Kootenay. A mining bulletin, published some time ago by the Provincial Government, gave brief information concerning that placer-gold field, as follows: "The commencement of mining operations in the East Kootenay district dates from 1864, when discoveries of rich alluvial gold deposits were made on Wild Horse creek, which flows into Kootenay river at Fort Steele. It is officially estimated that ordinary claims on two miles of this creek yielded from \$20 to \$30 to the man per day, and that from 1864 to 1866 five thousand persons were engaged in placer mining in East Kootenay. By the close of 1866 the locality was largely abandoned, except by Chinese, although in the early nineties the old workings have been operated by hydraulic methods." Under the heading "Fifty Years Ago To-day" the Daily Colonist, of Victoria, on December 18, 1914, reprinted from its early issue the following: "Kootenay Mines.—Mr. Fred White, the well known Cariboo packer, arrived here yesterday from the Kootenay mines. He states that some of the mines have taken out \$15,000 a month. It is expected that a large rush from California and the Boise, Idaho, mines will come in the spring." There has been more or less placer-mining on Wild Horse Creek ever since, and last year there was more gold reported to have been recovered than for a number of previous years.

The Trail "News" lately published the information that it is reported that requirements of **siliceous ore for its new copper converters** have caused the management of the Consolidated Mining and Smelting Co.'s smelter at Trail to contract with the West Hill Company, which recently took over the San Poll mine at Republic, Washington, under a lease and bond from the receiver, for 200 tons a month, at a freight and treatment rate of \$4 a ton, which is the lowest rate ever yet accorded Republic ores.

The erection of mine buildings for the accommodation of employees has been undertaken at the property, in Ashcroft mining division, of the Highland Valley Mining and Development Company. Mr. Frederic Keffer is president of the company and Mr. Henry Johns secretary. Both were for a number of years with the British Columbia Copper Co. The ore

occurring in the mine assays on an average 3 per cent. copper and about 60 cents in gold and silver to the ton. A concentrating plant is to be put in shortly.

DOMES EXTENSION.

According to Mr. W. S. Edwards, president of Dome Extension, Domes Mines, Ltd., has taken an option on Dome Extension property and assets, lasting until October 15th, 1917. The option has been sanctioned by the directorate of each company, but will have to be ratified by the shareholders of Dome Extension and a meeting of the shareholders will be held in the near future for this purpose.

The basis of the exchange is 46,000 shares of Dome Mines' stock for the 2,300,000 issued shares of Dome Extension, or 50 shares of the latter for 1 of Big Dome.

The Big Dome are permitted to diamond drill or do such work as they deem necessary during the tenure of their option, while the Dome Extension reserve the right to go on developing the property as heretofore, providing it does not interfere with the work of the Dome. The Dome management proposes to drive east from their No. 3 shaft on the 850-ft. level into Dome Extension territory, which will probably enter the latter at the 900-ft. level owing to the difference in elevation.

At the present time Captain Anchor is directing operations for Dome Extension on the 100 and 200-ft. levels. The work is being carried on with the money received from the recent sale of treasury stock.

DRILLING AT FLIN FLON LAKE.

Sudbury, April 1.—The diamond drills on the Great West Sulphide Mines at Flin Flon were put in operation early last week, and the first core of the drilling was brought to The Pas on Sunday. Mr. Hammell brought the core in and he is greatly enthused about it. Mr. Durkee, the drill contractor, returned with him and his enthusiasm knows no limit. He says it is a remarkable looking sight to see an orebody stripped in width for 200 ft. and every foot showing solid ore. He very earnestly recounted the features as they appeared to him, and he declares he will stake his reputation on the favorable outcome of the drilling. Night and day shifts are being worked on the diamond drills and more men will be placed to work as they are secured. It is a rush order and minutes are valuable to the workers.

Mr. Hammell feels satisfied with the way things are moving. He leaves the property in charge of three mining engineers, with instructions to push development along at a rapid pace.—Sudbury Journal.

SILVER PRICES.

		New York, London,	
		cents.	pence.
March	24.....	60¾	28½
"	25.....	60¾	28¾
"	27.....	59¾	28½
"	28.....	60¾	28½
"	29.....	60¾	28½
"	30.....	60¾	28½
"	31.....	60¾	28½
April	1.....	60¾	29
"	3.....	61¾	29¾
"	4.....	61¾	29½
"	5.....	61¾	29¾
"	6.....	61¾	....
"	7.....	61¾	29¾

MARKETS

NEW YORK MARKETS.

April 7, 1916—Connellsville Coke—

Furnace, spot, \$2.75 to \$3.00.

Contract, \$2.50 to \$3.00.

Foundry, prompt, \$3.75.

Contract, \$3.50 to \$4.00.

April 7, 1916—Straits Tin, nominal, 53.50 cents.

Copper—

Prime Lake, nominal, 27.50 to 28.00 cents.

Electrolytic, nominal, 27.50 to 28.00 cents.

Casting, nominal, 26.00 to 26.50 cents.

Lead, Trust price, 7.50 cents.

Lead, outside, nominal, 7.62½ to 7.87½ cents.

Spelter, prompt western shipment, nominal, 18.55 to 18.80 cents.

Antimony—

English brands, nominal.

Chinese and Japanese, 43.00 to 44.00 cents.

American, 43.00 to 44.00 cents.

Aluminum—nominal.

No. 1 Virgin, 98-99 per cent., 59.00 to 61.00 cents.

Pure 98-99 per cent. remelt, 57.00 to 59.00 cents.

No. 12 alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$155.00.

Platinum—nominal, \$88.00.

Cobalt (metallic), \$1.25.

Silver (official), 61⅝ cents.

Metal Products.—All prices are nominal as follows:

Sheet copper, base, 34.50 cents.

Copper wire, base, 29.00 to 29.50 cents.

High sheet brass, base, 36.00 cents.

Seamless brass tubing, 42.00 to 42.50 cents.

Seamless copper tubing, 43.50 to 44.00 cents.

Braze brass tubing, 42.50 to 44.50 cents.

Brass wire, 36.00 cents.

Brass rods, 36.00 cents.

Sheet zinc, f.o.b. smelter, 25.00 cents.

TORONTO MARKETS.

April 11—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 9¾ cents per lb.

Tin, 58 cents per lb.

Antimony, 45 cents per lb.

Copper casting, 30 cents per lb.

Electrolytic, 31 cents per lb.

Ingot brass, yellow, 16 cents; red, 21 cents per lb.

April 11—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

STANDARD MINING EXCHANGE.

Toronto, April 10, 1916.

Cobalt Stocks.

	Ask.	Bid.
Bailey	.06¼	.06
Beaver Consolidated	.39	.37½
Buffalo	1.30	.....
Chambers Ferland	.23	.22½
Coniagas	4.65	4.00
Crown Reserve . . . . .	.....	.49
Foster	.10½	.09½
Gifford	.07⅞	.07
Gould	.00¾	.00⅝
Great Northern	.04¾	.04¼

Hargraves	.05	.04½
Hudson Bay	30.00	25.00
Kerr Lake	4.35	4.15
La Rose	.63	.58
McKinley Darragh S.	.46	.43
Nipissing	7.50	7.12½
Ophir	.05¼	.04¼
Peterson Lake	.26¾	.26½
Right of Way	.05¼	.04¾
Seneca Superior	.41	.40
Silver Leaf	.02¾	.02¼
Silver Queen . . . . .	.....	.01¼
Shamrock Con.	.15	.14½
Timiskaming	.56½	.56
Trethewey	.20½	.20
Wettlaufer	.08¼	.07
York Ont.	.02½	.02¼

Porcupine Stocks.

	Ask.	Bid.
Apex	.05¼	.04¾
Dome Con. . . . .	.....	.12
Dome Extension	.38	.37½
Dome Lake	.27	.26
Dome Mines	25.50	.....
Foley O'Brien	.59	.50
Gold Reef	.02½	.01¾
Homestake	.50	.46
Hollinger	27.50	27.00
Jupiter	.20¼	.19¾
McIntyre	.91½	.91
McIntyre Ex.	.30	.27
Moneta . . . . .	.....	.10½
Porcupine Crown	.74	.73
Porcupine Gold	.00⅝	.00⅝
Porcupine Imperial	.03¾	.03⅝
Porcupine Tisdale	.01⅞	.01½
Vipond	.54	.53½
Preston E. D.	.04½	.04
Schumacher G.	.50	.43
Teck Hughes	.18½	.....
West Dome	.17	.16¼
West Dome C.	.24	.23½

NEW YORK STOCKS.

	High.	Low.	Close.
		April 10, 1916.	
Allis Chalmers	29½	29	29
Anaconda	87⅞	86⅝	87⅞
Beth. Steel	479½	461	479½
Chino	55⅞	54⅞	55
Crucible	93½	92	92¼
Dome	25	24¾	25
Goodrich	80	78⅝	79¾
Gt. Nor. Ore	43⅞	43½	43½
Int. Nickel	50½	49¾	50
Kennecott	57⅞	57¼	57½
Lead	67¼	67	67¼
Miami	38¾	38½	38⅝
Lack. Steel	77¼	77	77
Nev. Cons.	18	17½	17⅞
Ray Cons.	24⅞	23¾	24¼
Smelting	102½	102	102¼
Tenn. Cop.	52⅞	52⅝	52½
U. S. Steel	85⅞	84⅝	85
do., pref.	117⅞	117¼	117⅞
Utah Cop.	82⅞	82⅞	82⅝
Anaconda	87⅞	86⅝	87¼

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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- Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.
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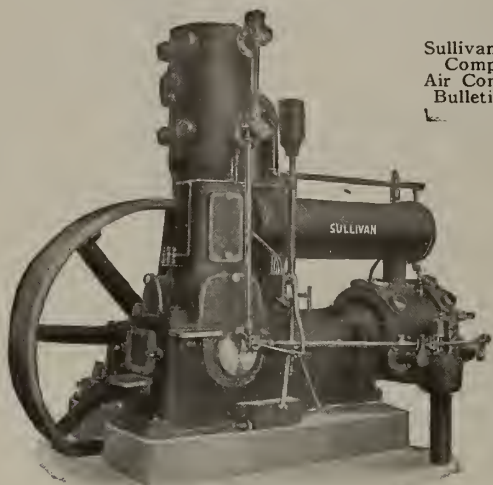
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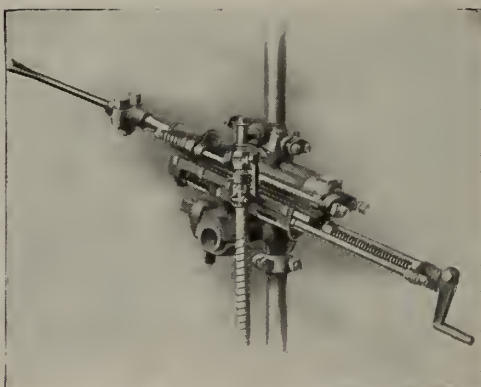
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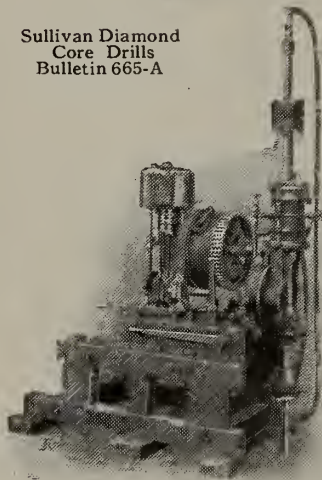
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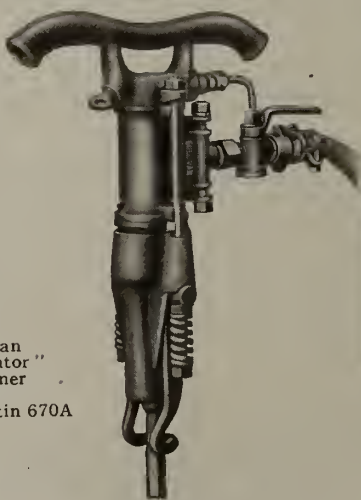
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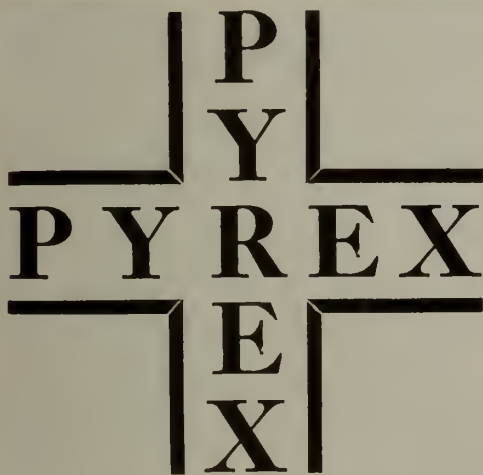
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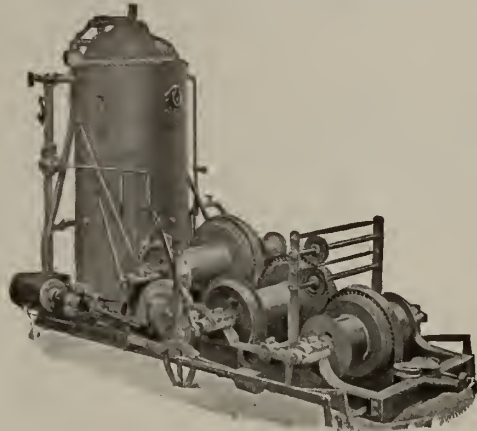
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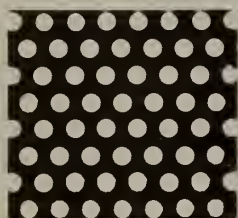
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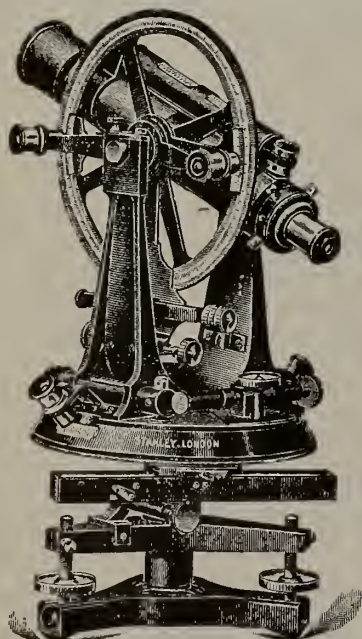
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The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1894, inclusive, \$88,904,199; for five years, 1894-1899, \$46,906,258; for five years, 1899-1904, \$90,391,394; for five years 1904-1909, \$121,618,733; for five years, 1909-1914, \$139,002,161.

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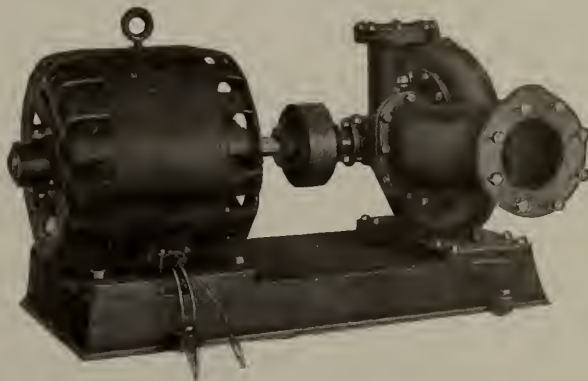
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Department of Colonization, Mines and Fisheries

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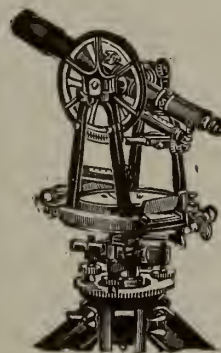
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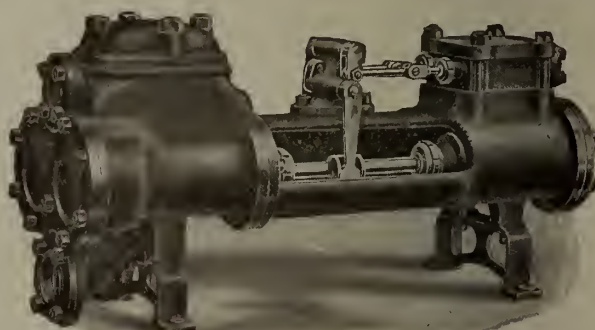
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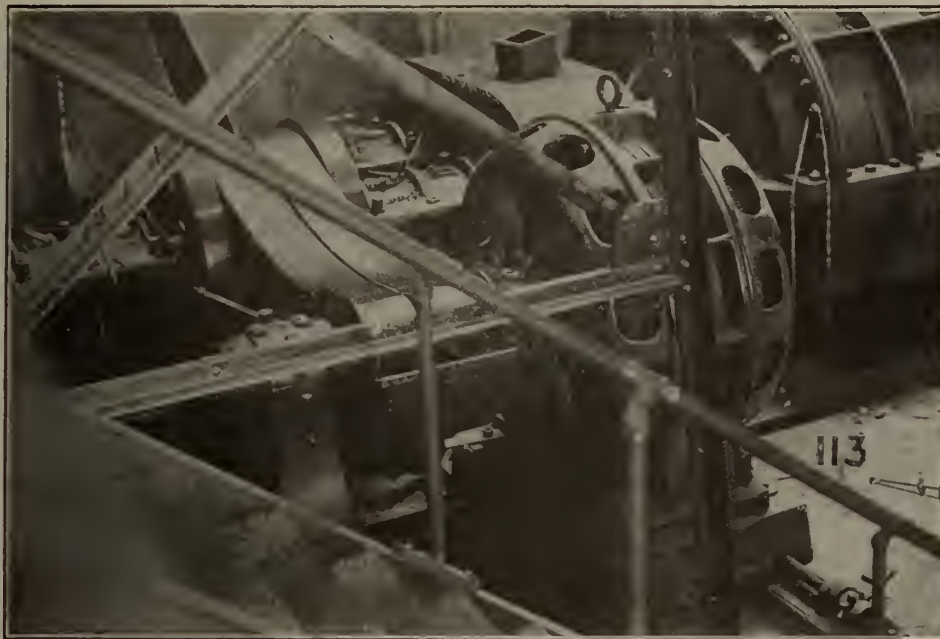
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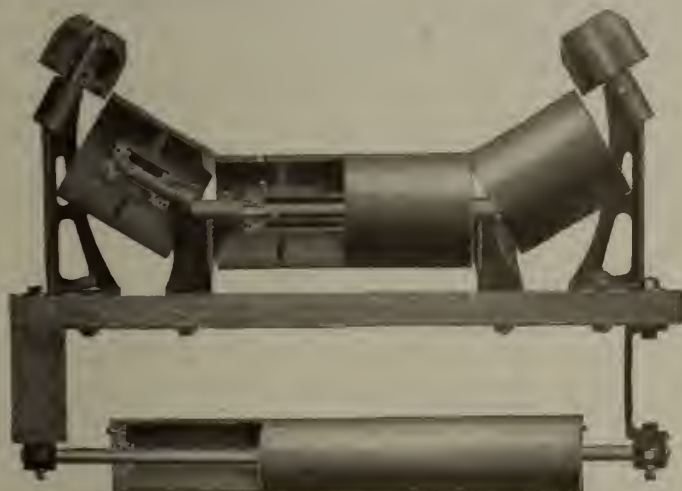
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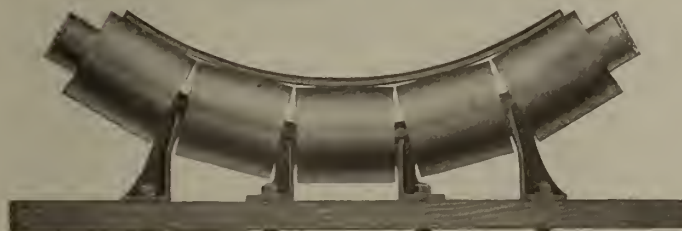
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, May 1, 1916.

No. 9

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office 263-5 Adelaide Street, West, Toronto

Branch Office 600 Read Bldg., Montreal

Editor

REGINALD E. HORE

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CIRCULATION

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PORCUPINE

As a producer of gold, Ontario has made very rapid strides during the past five years. Porcupine, in 1909 a thickly forest-covered area with no industries and scarcely any inhabitants, is now one of the busiest centres in the Province. It is now producing gold in such quantity and has such great promise for the future that there is good reason to believe that gold mining in Ontario is destined to become a much greater industry than silver mining at Cobalt ever was. Cobalt has an excellent record and has placed Ontario high in the list of producers of silver. Cobalt has made itself felt in countless ways in the older parts of Ontario. Cobalt has produced at low cost silver worth many millions, has given profitable employment to several thousand men, and has made a market for supplies of all kinds, a market that the manufacturer and merchant have learned to appreciate. We contrast Porcupine with Cobalt, therefore, without disparaging the latter, but in order to emphasize what we believe to be the importance to Ontario of the gold mining industry which has so recently been established in the province.

SILVER

The price of silver has risen so rapidly during the past few months that it is difficult to keep track of the actual increase in the value of silver mines which the increased selling price has made. In 1915, Ontario's silver output was 23,730,839 ounces. The average selling price was 49.69 cents. Silver is now selling at about 18 cents higher than the average for 1915. The increased profit if the 1915 output had been sold at this price would be over \$4,000,000. What the production will be in 1916 is difficult to estimate. It will probably be considerably lower than that of 1915 unless special endeavor is made to take advantage of the high price available. As it is generally believed that the price is more likely to rise than to fall, no special effort to market ore may be made. There can be no doubt, however, that more development work will be done at Cobalt this year than for some time past, both at producing mines and on prospects. Claims now idle will receive attention. The increased price of silver is of great importance not only to the silver mining companies but to Ontario as a whole.

Ontario's mineral production in 1915 had a value of \$57,532,844. The value of the metallic products was \$47,721,180. It will not be surprising if the value of metallic products in 1916 exceeds last year's total for metallic and non-metallic combined.

GOLD MINES OF NORTHERN ONTARIO

Owing chiefly to the mines of the Porcupine district, Ontario is now the chief gold producing province of the Dominion. In the year 1909, when the deposits at Porcupine were discovered, the gold production of Ontario was \$32,445. In 1912, when Porcupine mining companies began shipping gold bullion, the output was \$2,114,086 and for the first time in the history of the province gold mining became an important industry in Ontario. Since then increase in production has been rapid, the gold output increasing to \$8,501,391 in 1915. Further large increase is to be expected. Ore containing gold valued at many millions has been opened up at the mines and the prospects of large additions being made to ore reserves are excellent. The chief producers are proving to be large and numerous. The leading producers are at present handicapped by their small mills. Hollinger, Dome and Acme milled a total of 758,976 tons of ore in 1915, but the orebodies are so large that plants with a capacity of two or three times that amount could be used advantageously. The increase in production during the past few years is shown below:

Gold Production of Ontario.

1910.	\$ 68,498	..
1911.	42,637	
1912.	2,114,086	
1913.	4,558,518	
1914.	5,529,767	
1915.	8,501,391	

These figures are indicative of wonderful growth of an industry which is contributing directly to the wealth of Ontario. If we interpret the situation correctly the increase in production of gold during the next few years will be such that gold mining will be generally recognized as one of Ontario's chief industries. A very



Sketch map showing location of Porcupine, Kirkland Lake; Munro, Boston Creek and Kowkash gold areas.

large production from the mines now operating is assured, and if development at the properties now being worked and prospecting of other areas does not lead to many more valuable gold deposits being discovered we will be very much surprised.

The mines contributing to the gold output of Ontario in 1915, were: Hollinger, Dome, Acme, McIntyre, Por-

cupine Crown, Vipond, Dome Lake, Gold Reef, Schumacher, Porcupine Pet, Rea, and Porphyry Hill in the Porcupine district, Tough-Oakes at Kirkland Lake, Croesus in Munro township, Canadian Exploration Co.



Sketch map showing Tisdale and neighboring townships

at Long Lake, Cordova in Belmont township, and Olympia. Of the 17 gold mines producing in 1915, 12 are in the Porcupine district. These 12 produced \$7,580,766.

The record of the leading producers, as reported to the Ontario Bureau of Mines, for 1915, was as follows:

Mine.	Ore milled, Gold recovered, Value		
	tons.	ounces.	per ton.
Hollinger.	334,750	156,573	\$9.67
Dome.	317,740	73,726	4.79
Acme.	106,486	49,933	9.69
McIntyre-Porcupine. . .	101,955	36,094	7.31
Porcupine Crown. . . .	46,419	29,032	12.92
Tough-Oakes.	26,196	26,658	21.04
Vipond.	35,899	11,871	6.83

The year was marked by a number of promising discoveries, some of them in new, or comparatively new, territory. The Beattie-Munro area was the scene of a rush caused by the phenomenally rich strike at the Croesus mine, formerly known as the Dobie-Leyson. The quality of the ore from the shaft of this mine may be judged by the fact that from 800 pounds' weight of quartz \$40,000 worth of gold was recovered. Finds were also made in the south parts of Boston and McElroy townships and in the north parts of Pacaud and Catharine. The centre of this area is distant about twelve miles southeast of Kirkland lake. At Kowkash, on the National Transcontinental railway, about 300 miles west of Cochrane, a spectacular showing was uncovered in the month of August. On sinking the rich quartz disappeared, but other promising veins in the neighborhood were located in the rush that followed. Rich ore was also discovered south of Dryden, near Lake Wabigoon.

For the whole province 1,036,387 tons of ore was treated, the yield being 411,588 ounces of gold and 77,126 ounces of silver, with a total valuation of \$8,539,887, or an average of \$8.24 per ton. The aggregate value of gold produced in Ontario to 31st December, 1915, was \$23,324,389.

Mr. T. F. Sutherland estimates the gold ore blocked out in gold mines operating in Ontario at \$40,000,000. He estimates the 1916 production at \$16,000,000.

HOLLINGER

The Hollinger is Canada's leading gold mine. It produced in 1915 334,750 tons of ore which yielded \$9.67 per ton. The reserves are very large and a long and profitable life is assured. The property was dis-

mine warrants further large additions being made to plant and provision had been made for such expenditures before the war tax on profits was announced. The war tax as originally announced would have taken a very large share of the Hollinger profits and would



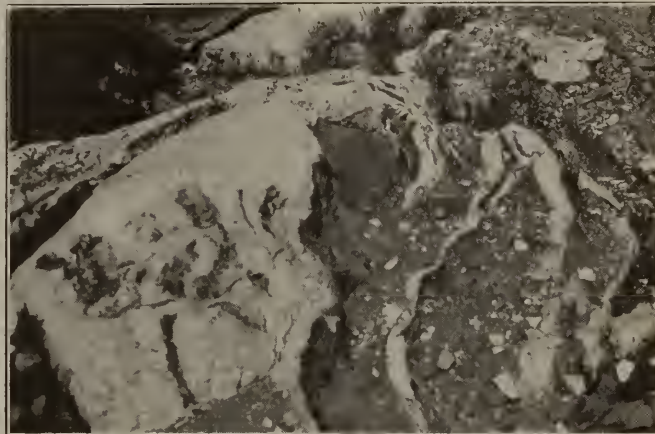
Hollinger and neighboring properties

covered in 1909 by Ben Hollinger and taken over in the same year by a syndicate composed of N. A. Timmins, L. H. Timmins, John McMartin, Duncan McMartin and D. A. Dunlap. A small production was made in testing the ore. A 30-stamp mill built in 1911 was destroyed by fire. Another was built in the following year and production on a large scale was first made in 1912 and in November, 1912 distribution of dividends began. During 1913 and 1914 dividends totalling \$1,170,000 per year were paid. In 1915 dividends totalled \$1,560,000. The milling capacity has been increased from time to time. During the four weeks ending March 24, 1916 there was treated 28,712 tons of ore averaging \$9.04 per ton.

For some reason, probably because of uncertainty as to the amount to be collected by the Government in taxes, the Hollinger report for 1915 has not yet been



Gold Ore, Hollinger mine



Gold Ore, Hollinger mine

have prevented necessary expenditures for enlarging the plant. It is expected, however, in view of Sir Thomas White's explanations, that while the Hollinger will have to contribute a considerable amount on account of the tax it will be a much smaller amount than the budget speech indicated, and should not seriously interfere with plans for increasing production.



Gold Quartz, Millerton mine

issued. It will doubtless show a substantial increase in ore reserves and prove that the property is a very valuable one.

During the past few years the Hollinger has necessarily made large expenditures for plant, but has been able to pay large dividends at the same time. The

The Hollinger mine is operated by the Canadian Mining and Finance Co. and the plans for extension of operations include provision for operating the Acme and Millerton.

It is generally believed that some plan for consolidation of the three properties has been worked out and will soon be announced. Nothing authoritative concerning such a merger is, however, yet obtainable. These three properties if operated as one would make one of the greatest mines in the world.

General Manager P. A. Robbins, in his report for four weeks ending March 24th, 1916, states that gross profits for the period amounted to \$151,302.63. Expenditures for plant during the four weeks amounted to \$19,598.10. Total working costs were \$101,287.31, an average of \$3.527 per ton of ore milled. There was hoisted from stopes 25,887 tons ore, and from development work 2,880 tons ore. Waste rock from development amounting to 1,950 tons was hoisted, bringing the

ton properties. This shaft has six compartments. Cross-cuts to tap the various orebodies will be driven at the 425, 800 and 1,250-ft. levels and electric locomotives will be used to haul the ore to the shaft. The ore will be crushed underground and then hoisted. At the surface it will be delivered to secondary crushers.

Two compartments will be used for hoisting ore, two for men and supplies, one for carrying on development work at lower levels and ore for ladderway, pipes and electric conductors.

CANADIAN MINING AND FINANCE CO.

The Canadian Mining and Finance Co. acts as general manager for the Hollinger company and owns and operates the Acme and Millerton properties adjoining the Hollinger. The officers are: L. H. Timmins, president; J. McMartin, vice-president; D. A. Dunlap, treasurer; J. B. Holden, secretary; and P. A. Robbins, general manager.



HOLLINGER MINE, TIMMINS, ONT.

ore and waste up to 30,717 tons. The mining cost was \$55,629.29, an average of \$1.93 per ton of ore milled.

The mill ran 92.3 per cent. of the possible running time, treating 41,493 tons, of which 28,712 was Hollinger ore and 12,781 tons was treated for Acme Gold Mines, Ltd. The average value of Hollinger ore treated was \$9.04. Milling costs on 28,712 tons were \$0.92 per ton.

ACME

The property of Acme Gold Mines, Ltd., adjoins the Hollinger. It is operated by the Canadian Mining and Finance Co., Ltd. The development work has proven the Acme to be one of the best properties at Porcupine. Large bodies of ore of good grade have been blocked out and it is evident that the Acme will make big profits. The estimated value of the ore reserves has not yet been made public, but it is expected that an announcement will soon be made.

It is understood that the Acme has ore reserves which warrant the construction of a much larger mill and cyanide plant. During 1915 106,486 tons ore, yielding \$9.67 per ton, was milled.

THE HOLLINGER-ACME SHAFT.

The Canadian Mining and Finance Co. is sinking a central shaft to serve the Hollinger, Acme and Miller-

ONTARIO'S MINES.

"The materials mined in Ontario are silver, gold, copper, nickel, iron, graphite, pyrites, talc, mica, feldspar, gypsum and corundum. The gold, silver, nickel, copper and iron are produced principally in the northern part of the province and the graphite, talc, mica, feldspar and corundum in the southeastern sections. As regards the importance of these deposits, it is claimed that Ontario has the largest body of high-grade talc on the continent in the Cross and Wellington talc mine at Madoc; the largest body of high-grade feldspar on the continent in the Richardson mine near Verona; the greatest mica mine on the continent at Sydenham; the greatest graphite mine at Calabogie; the greatest nickel deposits in the world at Sudbury; the richest silver camp in the world at Cobalt, and the most promising of the younger gold camps on the continent at Porcupine."—T. F. Sutherland, in E. & M. J.

KRIST.

Arrangements have been made for development of the Krist property which adjoins the North Thompson at Porcupine. Work will soon be begun on the property.

The Hollinger report for 1915 has not yet been issued. In view of the rumored merger of Hollinger and adjoining properties it will be of special interest.

DOME

The Dome mine is being operated with excellent results. The orebodies are very large and the cost of mining lower than at other Porcupine mines. During 1915 a large body of ore of higher grade was opened up at the sixth level and when this is being more largely drawn on the profit per ton will be considerably higher.

The 80-stamp mill now in operation has proven to be too small for the mine. A large tonnage is being handled and additions have been made wherever possible to increase the capacity. During 1915 there was milled 317,740 tons ore which yielded an average of \$4.79 per ton. A larger tonnage and higher grade ore will be milled this year. If future development in the mine is as successful in opening new orebodies as previous work has been, the construction of a new mill cannot be avoided.

The Dome orebodies are of such a size that methods of mining quite different from other Ontario gold mines have been adopted. A large portion of the pres-

way. The results obtained will doubtless greatly influence the design of the new mill.

Recently the Dome have secured an option on the adjoining property of the Dome Extension. Prospecting of the ground between the Dome shaft and Dome Extension and of the latter property will be conducted from a crosscut to be driven from the new shaft. This ground is as yet unexplored. That it may prove valuable is indicated by the result of other underground work at the Dome, good ore having been found in driving the crosscut to connect with the new shaft at the seventh level.

DOMES EXTENSION.

The Dome Extension Mines Co., Ltd., owns five claims adjoining the Dome mine. Development work was recently resumed by the company and additional work will be done from the Dome mine by Dome Mines, Ltd., the latter having recently secured an option on Dome Extension.



GOLD QUARTZ AT DOME MINE

ent production is made from open pits. The underground openings are very large and the method of mining will be similar to that at the Creighton nickel-copper mine.

At the Dome a central shaft, five compartments, is being sunk. Good progress has been made. Preparations for erection of the head frame are now under way. There will be two hoists, one being used only for raising and lowering men.

Some time ago it was decided to install an enormous crusher underground. This crusher is not yet in operation, but work on the crusher station has been resumed. In the stopes the ore breaks very large and much has to be broken up by block-holing. The underground crusher will be for preliminary reduction only. At surface another crusher will be installed.

In the mill a Hardinge ball mill is now in operation and a second will soon be erected. A large tonnage is being handled by the ball mill and considerable importance is attached to the competitive test now under

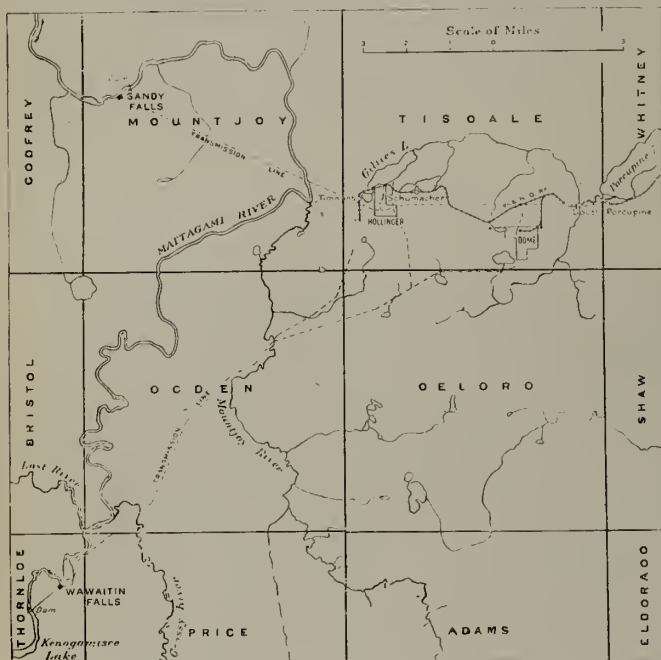
WEST DOME.

Cobalt, April 22.—On the West Dome Consolidated a diamond drill is now running. It is being put down at an angle for a distance of about 800 feet, so that it will give indications what may be found below the present shaft at 600 to 700 feet. After a good deal of trouble—for the plant was left in very bad repair—it has been possible to resume operations in the old incline shaft put down on a quartz vein at an incline of 65 degrees. The shaft follows one vein down and there is another vein in the north drift and another in the south. Very little information was available as to results obtained from these veins, but they will now be carefully sampled. There were no less than seven shafts sunk on the property but for the present underground operations will be confined to the one. The incline shaft will be sunk to the 300-foot level when it is probable a new plant will have to be installed, if it is decided to explore from this shaft.—Northern Miner.

HYDRO-ELECTRIC POWER AT PORCUPINE

Water power is an important factor in all the important mining districts in Ontario. A brief report by Mr. W. R. Rogers of the Ontario Bureau of Mines, on the water powers of Porcupine district was recently published. Mr. Rogers says in part:

"All the hydro-electric power furnished the Porcupine camp comes from two plants situated on the Mattagami river, a tributary of the Moose flowing into James Bay. The location of the power plants with respect to the mining area is indicated on the accompanying sketch map. Both of these were formerly



Sketch map showing location of water powers at Porcupine

independent plants, but now are controlled and operated by the Northern Canada Power Company, Limited. The two plants are provided with inter-switching facilities, so that they work continually in parallel. The new company has expended a great deal of money in new construction replacements, and betterments, so as to guarantee to power users continuous and satisfactory service.

Storage of water is perhaps the most vital point in connection with any hydro-electric development. It is absolutely essential that the water supply be continuous. High-water periods in Northern Ontario are at the time of the spring breakup, and to a much less extent during the late autumn, when rains are usually fairly abundant. February and March have been the months when water becomes scanty, particularly in those winters when the usual thaws did not occur. How to provide for low-water periods without reliance upon auxiliary steam plants is a problem that can be solved only when abundant storage is possible. The experience of the power plants on the Mattagami river has very definitely established this fact.

Pondage may be considered as the close-at-hand storage of water immediately available for use in the turbines. It is a necessary precaution in Ontario water powers in order to provide against ice troubles as well

as to meet local fluctuations in power needs during the day. Three distinct types of ice are met with: surface or sheet, anchor, and frazil. The first, in addition to restricting the area of the channels, is liable to cause jams in the spring, cutting off the water supply or raising the tail water with a consequent loss of head. Anchor ice frequently rises in large masses, often carrying boulders and soil which are liable to damage the ice racks. Frazil ice, in the shape of needles, forms in rapids when the temperature is slightly below the freezing point. These needles or crystals gather in lumps and adhere readily to any surface with which they come in contact. Trouble from these latter sources is avoided when a long stretch of still water exists above the power house, while surface ice trouble is largely overcome by proper dam construction.

Prior to the erection of the large plant of the Abitibi Power and Paper Company at Iroquois Falls, on the Abitibi river, where an installation of 19,500 horsepower was first operated in August, 1914, the two power plants on the Mattagami river were the only ones in Ontario on the James Bay slope. Consequently their experience is of value to other power developers and users. The James Bay drainage basin is very conservatively estimated as capable of developing 1,500,000 horse power, or 30 per cent. of the total potential water power of the Province of Ontario.

TOUGH-OAKES DECISION.

Toronto, April 25.—Judgments were given at Osgoode Hall of Mr. Justice Kelly in the twin actions concerning the control of the Tough-Oakes Mining Co. He continues to trial the injunction asked by C. A. Foster, restraining Myrtice Oakes and Winifred Robins from disposing of two blocks of stock aggregating 40,000 shares of \$5 each, which, he alleges, he bought from them. The interim injunction had been granted by Mr. Justice Latchford.

Mr. Justice Kelly dismisses the application of Harry Oakes, W. H. Wright, J. W. Morrison, R. J. Robins, J. B. Holden, Albert Burt, and James Y. Murdoch, for an injunction restraining C. A. Foster, J. H. Tough, T. B. Tough, George Tough, E. W. Kearney and W. H. M. Jones, acting as directors of the Tough-Oakes Mining Co.

The company was incorporated in 1913, with a capital stock of \$3,000,000, of which 531,500 shares have been issued.

The controversy over the control of Tough-Oakes was brought to a head at the annual meeting of the company last January, in Haileybury, when C. A. Foster, the president, claimed that there was not sufficient stock represented to make a quorum and dismissed the meeting. Harry Oakes and his associates differed with the president and went ahead and elected a new board of directors. The ruling of Mr. Justice Kelly leaves the old directorate with Mr. Foster, as president, in control, as before.

In the meantime, while the legal entanglements were being cleared up, production at the mine went on as usual.—Toronto World.

LAKE SHORE MINE.

Kirkland Lake, April 22.—Probably the most important discovery at the Lake Shore mine to date has just been made on the 300-foot level. The new vein is about seven feet wide and for a width of seven inches averages \$400 a ton. It was cut in a crosscut north from the main drift, about 300 feet west of the shaft.

MCINTYRE PORCUPINE MINES

In a letter to shareholders, dated April 14th, 1916, President A. M. Hays says:

The following is a summary of production and development operations for the quarter ended 31st March, 1916: Tons milled, 27,248; value per ton, \$7.74; gross value, \$210,840; recovery, \$201,110—95.4 per cent.; operating cost, \$104,982—\$3.85 per ton; operating profit, \$97,128.

Owing to vexatious delays in obtaining delivery of necessary parts of the plant, the mill addition was not ready for operation until towards the end of March, so that the tonnage treated during the period is only slightly in excess of the tonnage treated for the quarter ending 31st December last. The value of ore treated, however, was 35 cents per ton higher, while the operating costs were 31 cents per ton lower, giving an increased operating profit of \$21,643 for the quarter. The mill is now operating satisfactorily and should be running to its full capacity of 450 tons per day before the end of the present month.



Gold Ore in McIntyre Mine

Developments underground have continued to be satisfactory. At No. 5 shaft on the 700-foot level a crosscut to the north intersected a large orebody which had been previously cut by diamond drilling. The width of the vein at the point of intersection was 17 feet of high grade milling ore. In continuing this crosscut to the north, a parallel vein was intersected at a distance of 12 feet beyond the orebody just referred to, showing high grade milling ore $4\frac{1}{2}$ feet in width. There have been no recent developments of any importance at No. 4 shaft, which is now being operated to the 600-foot level. Sinking operations to greater depths will shortly be commenced.

McIntyre Extension.

The main working shaft on the McIntyre Extension property was completed during last month to a depth of 1,000 feet, where a working station has been cut out. The shaft was continued to a depth of 1,083 feet in order to make provision for ore and waste pockets below the level, with a suitable sump. These have now been completed and a crosscut has been started towards McIntyre No. 5 shaft in order to intersect at this depth the orebodies already proved by diamond drilling to exist to the depth of 750 feet, and as the crosscut is now being driven at the rate of over ten feet per day, the distance should be covered early in June, when a raise will be started to connect with No. 5 shaft at the 700 foot level.

McIntyre-Jupiter.

Work on the new power plant, as well as on the new shaft house (in which are being placed the crushing and sampling plant) has been seriously delayed by tardy delivery of material and machinery necessary for their completion. The final shipments, however, have now been made. A surface tramway is being constructed to No. 5 shaft on the McIntyre, a distance of about half a mile over an easy grade, from which point Jupiter ore will be transported by the existing aerial tramway to the McIntyre mill. The Jupiter shaft is now in operation to the 300-foot level, and a considerable amount of underground work has been accomplished. Unless something unforeseen happens the mining and milling of Jupiter ores should be commenced within the next week or ten days.

McCREA-KILROY.

South Porcupine, April 22.—The claims in Deloro next to the Pike Lake properties known as the Mc-Crea Kilroy Gold Mining Company are the scene of active development this week. The management will strip a wide dyke, which runs from 40 to 60 feet wide, and select a good place for sinking. During the winter considerable surface work was done and two test pits sunk.

Quite a number of old-timers have gravitated back to the Porcupine gold camp after an absence of several years. Optimism seems to be in the air, and a general activity in mining claims, especially in Deloro, is vouched for.—Porcupine Herald.

CROESUS GOLD.

At the Croesus gold mine in Munro township the incline shaft is being sunk from the 300 to the 400-foot level. A quantity of ore from the Croesus was milled in the Gold Pyramid mill, but the plant was so sadly out of date that only a very poor recovery was made. The building of a new mill is being considered now by the Croesus company.—Cobalt Nugget.

CONIAGAS IN DELORO.

During the winter Coniagas Mines, Ltd., through Mr. Clifford Smith, of Toronto, secured an option on claims in Deloro township. Supplies were taken in during the winter and development work will be carried on this summer. Mr. Smith is in charge of operations.

CROWN RESERVE AT BOSTON CREEK.

The Crown Reserve Mining Co., Ltd., is developing under option claims in the Boston Creek district. Mr. H. J. Stewart, assistant manager of the Crown Reserve, is in charge.

PORCUPINE CROWN MINES, LTD.

In a report of the operations of Porcupine-Crown Mines, Ltd., for the year 1915, Mr. S. W. Cohen, general manager, says:

The net value of the production of the property for the past year, after deducting mint charges, was \$613,565.43; 46,419 tons was milled, of which 41,326 tons came from the mine, and 5,093 tons from the tailings of the first amalgamation mill; 23,964 tons of broken ore is on the timbers in the mine; 4,569 feet of development and prospecting was driven, and 2,616 feet of diamond drilling was done.

The orebody which was encountered on the 200-foot level during the last month of 1914, was developed for a length of 150 feet. The ore is of different character from the original quartz vein, being mineralized schist with small quartz stringers, and averages 15 feet in width with a value of \$5.45 per ton. South of this point, another displacement of the vein shows a throw of about 100 feet. Beyond this, the vein was followed for about 140 feet showing \$5.00 ore for a width of 5 feet.

was at this level, as, previous to that period, there was very little satisfactory development accomplished. During the year, the ore was followed south of the No. 2 winze, and for 90 feet the vein showed \$13.00 ore for a width of 4½ feet. Beyond that point, the vein went into the wall, and where it opened up again, shows vein matter 4 feet in width, but of a value of less than \$5.00. Just above the No. 2 winze, the vein takes a roll, and for a height of 20 feet and a length of 25 feet, there is mineralized schist averaging \$9.00 in value for a width of 57 feet. This is in addition to the regular high grade vein of about 4 feet in width which exists at that point.

600-foot Level—On this level, 205 feet of drifting has been done and 69 feet of crosscutting. There is a vein of quartz for the whole length of the drift about 4½ feet wide. For 20 feet in length, this averages \$17.40. The rest of the drifting shows ore too low grade to mine. Work was temporarily discontinued to allow the winze to be sunk to the 700-foot level, but there is no reason to expect that further values will not be encountered at this level. The winze from this level to the 700 was sunk on the vein and showed values at



PORCUPINE CROWN MINE AND MILL

300-foot Level.—10,296 tons of ore was broken at this level, and 210 feet of drifting, and 363 feet of crosscutting was done.

The fault was also encountered on this level at the south end of the ore shoot discovered last year, and considerable crosscutting was necessary before the extension, which was thrown about 100 feet in the horizontal plane to the left, was discovered. It was this discovery that supplied the data that made it possible to locate the vein on the other levels. The extension of the orebody opened up this year is 180 feet in length, and 5 feet in width, of \$10.00 ore.

400-foot Level—12,184 tons of ore was broken, 376 feet of drifting, 494 feet of crosscutting, and 99 feet of raising was done on this level. The extension of the vein south of the second fault was opened up for 135 feet, showing a width of over 4 feet of \$23.00 ore. The second extension was also picked up at this level, but the grade of the ore is low.

500-foot Level—8,088 tons of ore was broken at this level, and 530 feet of drifting, 600 feet of crosscutting, 111 feet of raising, 96 feet of sinking, and 93 feet of shaft raising was done. The most interesting and important development in the mine during the past year

different points. Drifting has been started at the 700 and shows a quartz vein 3½ feet wide with values running from \$2.00 to \$7.00. The main shaft was put down to the 500-foot level, and a larger hoist is being installed.

Diamond Drilling.—Two thousand six hundred and sixteen feet of diamond drilling was done, all in flat holes. This work proved very effective in locating the extension of the vein at different points where faulting had caused a movement of the ore, and this method will be continued as a cheap and effective one to locate the orebodies.

The results of our mill operations have continued to be most satisfactory. The extraction on the regular mine ore was increased to 97.7 per cent., and this on a lower grade of ore than the average of last year. The old amalgamation tails were successfully treated at a very low cost and gave an extraction of 85.77 per cent. This, together with the extraction made in the original amalgamation mill, shows a total recovery of 97.87 per cent. on the ore mined before the installation of the cyanide mill. The cost of milling for the year was still further reduced to \$1.09 per ton.

Cost of Operation.

The operating costs were again materially reduced for the year.	Per ton
The total cost of the ore treated, exclusive of the amalgamation tailings.....	\$6.72
The amalgamation tails were handled and treated at a cost of.....	.97
The total average cost of treatment including everything.	6.09

Distribution of Costs.

	Cost per ton milled.
Mining, development, exploration and underground	\$121,242.54 \$2.93
Hoisting and tramping.....	13,482.50 .32½
Mill operations	45,036.48 1.09
Power, heat and maintenance...	50,935.07 1.23
Mine, general expense.....	21,394.81 .52
Administration, depreciation, insurance and taxes.....	25,870.88 .62½
Total.	\$277,962.28 \$6.72
Tailings, handling and treatment.	4,954.60 .97
	\$282,916.88
Total average cost per ton milled.....	\$6.09½
Gross value, production	\$615,537.60
Mint charges	1,972.17
	\$613,565.43
Mine operation costs.....	282,916.88
Mine operation, net profit.....	\$330,648.55

Ore Reserves.

During the current year, almost all of our ore was developed south of our main fault at the 200, 300, 400 and 500-foot levels. Ore was found on each of these levels, and developed up to the second fault which cut the vein, but was again picked up beyond the fault and developed into the quartz-porphyry. The furthest point reached to the south was at the 200-foot level and is now within 150 feet of our south boundary. The general indications are that this formation, viz.: the quartz-porphyry, limits our orebody in this direction, although this territory will be further proved to finally determine this fact. The character of the new ore developed is different from the original portion of the vein, as it consists of mineralized schist with quartz stringers instead of a solid quartz vein as existed originally.

Fifty thousand tons of ore, of a value of \$400,000.00 was blocked out during the past year. The present total ore reserves are equivalent to 150,000 tons of an approximate value of \$1,250,000. The estimate of this value is of course based on mine sampling, but as a result of the mill checks on the mine samples we may assume this estimate to be correct within 10 per cent.

Summary of Results in 1915.

The development of the property during the past year has been satisfactory. We have opened up an extension of the orebody to the south and at the lower

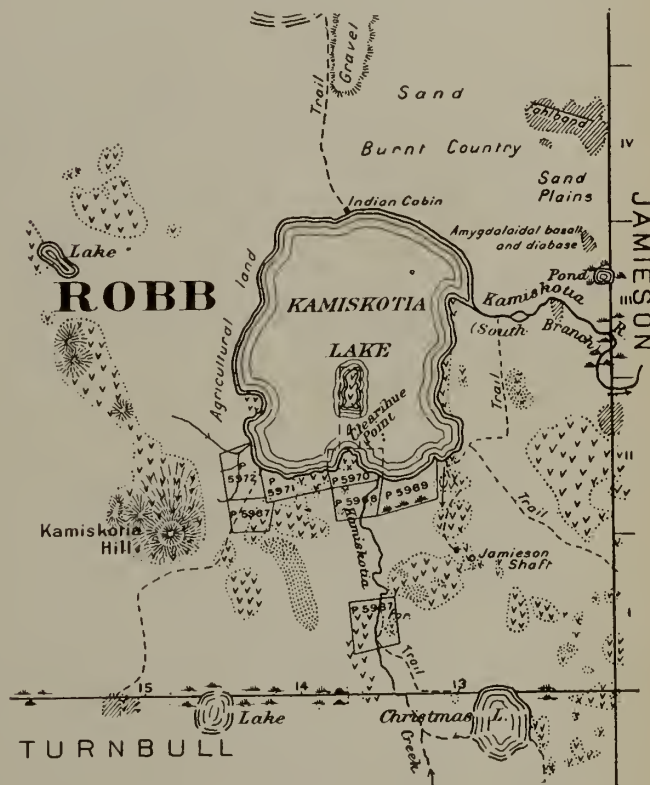
levels, have demonstrated the fact that although the ore is of lower grade where it does exist, it is of a value that will show a profit on operations. While the change in the character of the orebody reduces the grade per ton, the increase of tonnage gives us practically the same gold contents in the vein. Operating costs were appreciably reduced. Extraction in the mill was increased.

The company earned a profit of \$297,873.14 after wiping off all costs of broken ore left in the stopes, new development, depreciation, etc. Two hundred and forty thousand dollars was paid in dividends by the company, and \$57,873.14 was added to the surplus, making a net surplus of \$269,977.10.

KAMISKOTIA.

According to a report from Timmins the nine claims in the Kamiskotia district worked by the Porcupine Independence Mines, Limited, have been sold. This property is located in Jamieson township, at the junction of the north and south branches of the Kamiskotia river.

These properties were secured in the early days of the camp and the Porcupine Independence Mining Co.



PORCUPINE VIPOND MINES, LTD.

In his report to the president and directors of the Porcupine Vipond Mines, Ltd., on the operations of the company during the year 1915, Manager C. H. Poirier says:

During the year the drifts on the 200-foot level were extended to the west limits of the North Vipond lot and the continuation of the ore-bearing zone proven to the boundary of the property. A vertical, two com-



PORCUPINE VIPOND MINE

partment winze was sunk 220 feet from the 300-foot level and stations were cut at both the 400 and 500-foot points. The winze has been equipped with a cage and exploration work started on both the 400 and 500-foot levels. These levels will be extended to a point under the main working shaft and a connection made with it.

A summary of the work done to date follows:

	1915. ft.	Total to date-ft.
Sinking and raising.....	381.5	1,176.5
Drifting.....	1,198.9	4,101.3
Crosscutting.....	218.6	1,975.6
	1,799.0	7,253.4
Diamond drilling	524.0	524.0

The mill has been in continuous operation during the year. The installation of a 6-foot Hardinge ball mill, to replace one of the 4½-foot units and the building of a storage bin for the crusher resulted in increasing the capacity of the mill from 3,000 to 4,000 tons per month.

Thirty-five thousand eight hundred and ninety-nine tons of ore was treated in the mill, with the following results:

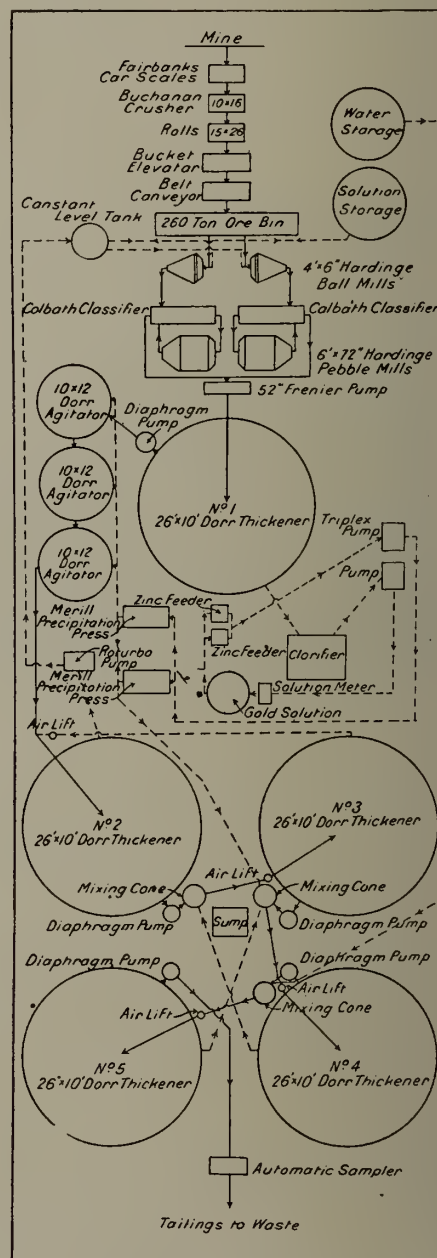
Gold bullion produced, 11,978.66 fine oz....	\$247,598.56
Silver bullion produced, 1,455.39 fine oz....	713.73
Total value recovered.....	248,312.29
Total value lost in tailings.....	21,355.13
Gross value of ore treated.....	269,667.42
Average value per ton treated.....	7.51
Loss per ton treated (tailings).....	.59
Recovery per ton milled.....	6.92
Extraction per ton milled.....	92.1%

The tonnage milled was drawn from the following sources:

	Tons.
Stopes.....	31,598
Development.....	4,077
Dump.....	224
Total.....	35,899

Distribution of Costs.

	Total.	milled. Per ton
Mining.....	\$76,743.96	\$2.14
Development.....	23,221.24	.65
Milling.....	55,477.33	1.54
Refining and marketing.....	4,382.96	.12
General.....	24,638.54	.68
Total operating.....	\$184,464.03	\$5.13
Head office, taxes, insurance, ad- ministration and interest....	12,455.31	.34
	\$196,919.34	\$5.47
Cost of 11,522 tons of ore broken but not milled.....	\$18,665.64	.52
		\$4.95



Flow Sheet, Vipond mill

The ore reserves on December 31st, were 90,000 tons, valued at \$587,280, of which 17,130 tons valued at \$93,000 were broken and stored in the stopes.

Additions to plant and equipment during the year amounted to \$15,794.97 and consisted of additions to

KIRKLAND LAKE

The Kirkland Lake district has one important producer of gold—the Tough-Oakes mine. Other properties in the district are now being energetically developed and there will be other producers before the end of the year. Prospects now idle will also receive attention. The districts looked promising a few years ago, but only one mine was brought to the producing stage and that one has been unfortunately the subject of

cupine district. Nevertheless, a good profit is being made and distribution of dividends begun. The mill is described elsewhere in this issue.

The Teck-Hughes mine is nearing the producing stage. This property is now controlled by the Buffalo Mining Co. A 50-ton mill has been erected and is nearly ready for operation. It resembles the Tough-Oakes plant. The ore will be crushed in ball and tube mills and cyanided. Electric power will be used, but is not yet available. Recently underground work, suspended for a time, has been resumed.



Shaft-house and compressor house, Tough-Oakes mine.



Tough-Oakes mill and cyanide plant, Kirkland Lake



New shaft-house at Teck-Hughes mine, Kirkland Lake.



McKane property, Kirkland Lake.

much litigation. Today, however, several properties are receiving attention.

The Tough-Oakes is a rich little mine; little compared with such mines as the Hollinger and Dome, but producing ore of higher grade. During 1915 there was milled 26,196 tons of ore, yielding \$21.04 per ton. The mill was started only in March, 1915, and the production in 1916 should be considerably larger than in 1915.

The Tough-Oakes ore is harder to mine and mill than most of the ore at Porcupine. Some of the orebodies are in comparatively soft greywacke and conglomerate; but a considerable portion is in a porphyry which has been found harder to drill and crush. Power and transportation facilities have had to be overcome and large expenditures on plant have been made. It is to be expected therefore that the cost per ton will not compare very favorably with the cost of mining and treating the large easily crushed orebodies of the Por-

The Lake Shore mine, on the shore of Kirkland lake, is operated by Mr. Harry Oakes. Development work has been carried on here with excellent results and recently high grade ore was cut at the west end of the 300-foot level. Several good shoots of ore have been opened by drifts at the 100 and 300-foot levels. The recent strike, if it proves of any length, will materially increase the quantity of known ore. The west drift had recently been in lean ground and the good ore was discovered by crosscutting a short distance, it being thought probable that the drift had not followed the main vein. The result of the crosscut makes this seem to have been the case.

Near the Teck-Hughes the Beaver Consolidated Mining Co., of Cobalt, is operating the McKane claims under option.

A few miles north of Kirkland lake, in the Goodfish lake area, operations are being carried on by La Belle Kirkland Mines, Ltd. This company took over the Gibson claims. A small plant was taken in during the win-



The Lake Shore Mine, Kirkland Lake, Ont.

ter, and development work is being carried on with good results. Mr. Frank Loring, of Toronto, is general manager.

There are other good properties at Kirkland lake and Goodfish which should receive attention. It is probable that some of them will be developed during the coming summer.

At Swastika, the stopping-off place on the T. & N. O. railway for Kirkland lake, are located the Swastika and Lucky Cross mines. The Swastika is at present idle. The Lucky Cross, after being idle for some time, is again in operation, the Trethewey Mining Co., of Cobalt, having taken an option on the property. The preliminary examination has proven satisfactory and work will be carried on steadily during the summer.



Stopping with Waugh machine, Tough-Oakes mine, Kirkland Lake, Ont.

MILLER-INDEPENDENCE.

Cobalt, April 22.—The Miller-Independence Mining Co., operating at Boston Creek, has been bagging high grade ore for a considerable time, from the five test pits which have been sunk. The main shaft is now approximately 35 feet deep, and will be continued to the fifty-foot level, and a crosscut will be driven to catch the vein, which is dipping at an angle of about thirty degrees.

A Dodge crusher has been installed, which will crush the ore to three-quarter mesh and deliver it to the Nissen stamps.

The amalgamation will be done in the mortar block of the Nissen, after which the pulp will flow over an amalgamating plate and into a trap, and from the trap will be pumped into the concentrating cones, after which the concentrates will be bagged and shipped to the smelter.

The new electric lighting plant has recently been installed on the property, and the camps and buildings will be lighted with electric light.



Drifting with Leyner-Ingersoll machine, Tough-Oakes mine, Kirkland Lake.

The five-drill compressor which was recently installed is now running smoothly and it is the intention of the management to put on two shifts and push ahead the sinking of the main shaft.

While sinking one of the test pits last week, the richest ore yet found on the property was discovered.—Cobalt Nugget.

LA ROSE IN DELORO.

The La Rose Mining Co. of Cobalt is developing under option claims in Deloro Township. Mr. G. C. Bateman is in charge of the work.

BOSTON CREEK

Boston Creek is a promising district in which important gold discoveries were made during 1915. It is easily reached by the T. & N. O. railway, one of the chief discoveries being less than a mile and another only a few miles east of the railway, at mileage 154, 51 miles north of Cobalt. A siding for freight has been

The R. A. P. Prospecting, Developing and Mining Syndicate, owners of several claims in the district, are operating the R. A. P. mine where good ore is being developed by shaft and drifts. The syndicate is composed of E. M. Richardson, W. B. Albright and J. K. Papasimakes, of New York.

The Miller Independence Co. is operating the McDonough claim. The vein has been tested by several



Boston Creek Station, Mileage 154, T. & N. O. Railway



Boston Creek Station and Inn



Boston Creek Inn



On the road to Miller-Independence mine, Boston Creek



On road to R. A. P. Mine Boston Creek

constructed and the trains stop regularly. The Boston Creek Inn, located close to the station, is an admirable stopping place.

The indications are that there will be much activity in this district during 1916. At present three companies are operating.

shallow pits and a shaft is now being sunk. Mr. Miller, president of the company is very enthusiastic. He states that the work so far done has been very encouraging, gold being found in considerable quantity in all the openings. He has installed a small plant and a Nissen stamp and expects to be soon shipping concentrate.

The Crown Reserve Mining Co., of Cobalt, is developing under option the McCrea claims. A small plant has been installed and the sinking of a shaft begun. Encouraging results have been obtained.

The Ontario Bureau of Mines has nearly ready for publication a geological map of the Boston Creek district. Mr. A. G. Burrows and Mr. P. E. Hopkins examined the area last year and their preliminary report will soon be ready. Mr. Burrows will visit the area again this month.

Boston Creek is regarded by many who have examined properties there during the past year as very promising. Rich ore has been found on several properties. Development work now under way is meeting with good results. It is probable that the district will soon be a producer.



The R. A. P. mine, Boston Creek



The R. A. P. mine, Boston Creek



McCrea claim, Boston Creek



McCrea claim, Boston Creek

SCHUMACHER.

The Schumacher Gold Mines Ltd. was incorporated in 1914. The company operates the Schumacher mine which adjoins the McIntyre. F. W. Schumacher of Columbus, Ohio, is president. Mr. S. W. Wookey is manager, having succeeded Mr. Jos. Houston, who is now on the Dome staff.

The Schumacher is generally regarded as a good little mine. It is, however, not extensively developed and the amount of ore blocked out is small. A mill was constructed in 1915 and put into operation in October.

GOLD AT HALFWAY LAKE ?

The Pas, April 22.—A gold strike is reported at Halfway Lake, which is three miles off the Hudson's Bay Railway, at Mile 130. John Anderson, a rock fill contractor on the railway, says a bunch of Swedish railway men have staked 150 claims near the lake, though only a small number have been recorded.

SUDBURY.

In an article written for the Engineering and Mining Journal, New York, Mr. T. F. Sutherland, chief inspector of mines of Ontario, says:

"Sudbury is the greatest of Ontario's mining camps yet discovered, both in size of orebodies and their value. At the beginning of 1916 Sudbury was producing at the rate of \$48,000,000 in metals per year—\$38,000,000 in nickel, \$9,000,000 in copper and \$1,000,000 in gold, silver, platinum and palladium, based on the December, 1915, prices of refined metals. Seventy-one million tons of ore is proved in the Sudbury district, and while this is called a nickel ore and is mined primarily for its nickel contents, the tonnage carries in addition two billion pounds of copper and approximately \$60,000,000 in gold, silver, platinum and palladium."

GOLD ORE FROM MUNRO.

Matheson, April 22.—This week the Croesus started shipping high-grade ore. Two shipments have been made, but outside of that it contains a high gold content, nothing authentic could be learned. Last fall the company shipped a ton of ore that ran between 2,000 and 2,500 ounces in gold, or of a value of about \$45,000. It was the highest grade ore shipment ever made from northern Ontario. The high-grade ore from which shipments are now being made is coming from the 100 and 150-foot levels. The shaft is in the vein at 380 feet.—Toronto World.

GOWGANDA.

Elk Lake, April 21.—A promising looking patch of rich silver ore has been found by the Bishop Silver Mines at Calcite Lake, in the Wigwam district of Gowganda. The high-grade ore was found in the adit, 800 feet in.

GEOLOGICAL FEATURES OF THE PORCUPINE GOLD AREA*

By A. G. Burrows.

The Porcupine gold area, which for the past six years has held the attention of the mining public, is situated on the Hudson Bay slope of northern Ontario. The latitude of Niven's First Base Line of 1899, which forms the south boundary of Tisdale and Whitney townships is 48 deg. 27 min. 54 sec; consequently the area is somewhat farther south than the Canada-United States boundary in Manitoba and other western provinces. The camp is in the Timiskaming judicial district. Lying along the southern fringe of the great clay belt of northern Ontario, it adjoins a prospective farming country. In this belt many townships have been laid out in six or nine-mile squares and subdivided into concessions and lots; in the gold area itself and in the adjoining country to the north, many half lots containing 160 acres each have been granted to veterans as homesteads.

It is remarkable that the earliest discoveries at Porcupine have been developed into the largest producers. The outstanding mine is the Hollinger, named after its discoverer, Benjamin Hollinger. The discoveries on Pearl lake by Alexander McIntyre developed into the McIntyre mine, and that of John Wilson in the southeast part of Tisdale into the Dome mine. The large producing mines are all confined to Tisdale township, and the majority of these are in the vicinity of Pearl lake.

The principal towns of the area are Timmins, South Porcupine and Schumacher. The town of Timmins is most progressive, and is growing rapidly. The town is situated on a sand and gravel ridge overlooking the Mattagami valley, at an elevation of about 110 feet above the river.

To the northwest and west of Timmins a number of farms are being cleared along the Mattagami river. It is desirable to have a great part of the townships immediately north of the Porcupine gold area, which are in the clay belt, settled, as the farmers will have a near-at-hand market for their produce.

A branch line of railway connects the Porcupine camp with the main line of the Timiskaming and Northern Ontario railway. The line from Porquis junction to Timmins is 33½ miles in length, and the distance from Timmins to Toronto is 485 miles. When through trains are running the journey requires about 20 hours.

The First Prospecting.

In 1906 some work was done by prospectors on a vein near Miller lake and a few hundred feet from the present Hollinger veins. Evidently, seeing no gold, and having no assays made, they abandoned the property. In the same year claims were staked in Shaw township on what is described in the application as a "vein of sugar quartz and hematite iron." This is of interest since the so-called vein is simply the upturned edges of the Keewatin iron-formation.

In 1908 claims were staked by H. F. Hunter on the east shore of Porcupine lake. Gold was found sprinkled through the quartz and schist in a sheared zone.

It was not, however, until the following year that the spectacular discoveries of J. S. Wilson, on what is now the Dome property, caused a rush to the dis-

trict, and in a few weeks practically all of Tisdale and a great part of adjoining townships and unsurveyed territory were staked.

Since the discovery of gold in this area there have been repeated forest fires which have destroyed much timber. The worst fires in recent years occurred in 1911. About the middle of May of that year a fire completely destroyed the surface plant and buildings of the Hollinger mine.

The greatest fire of the year occurred on July 11th, when, after a prolonged dry season, a hurricane from the southwest brought up a fire. The surface workings and buildings of the Dome, West Dome, Vipond, Standard, Preston, East Dome, North Dome and several other properties were entirely destroyed by fire. The town of South Porcupine was completely wiped out, and almost all the part of Pottsville which escaped the fire of July 2nd. The north part of Porcupine (Golden City) was also destroyed. This fire was attended by a great loss of human life, 71 in all having lost their lives either by being burned, suffocated or drowned. The destruction of the surface plants by this fire retarded the production of the camp for almost a year.

Keewatin Rocks.

The rocks of Porcupine are largely igneous, and the greater part of them belong to the Keewatin. It is difficult to procure specimens of these old igneous rocks which are at all well preserved. In consequence, it is difficult, if not impossible, to make a close division of the Keewatin igneous rocks. Field evidence is abundant to show that the Keewatin is composed largely of volcanic rocks.

A great part of the Keewatin rocks is now altered to schist, and such terms as grey schist, green schist, hornblende schist, carbonate schist are used to describe certain rocks in various localities. These terms do not give much idea of the original mineral composition; for example, a grey schist may have been derived from a rhyolite or from a basalt. The terms grey schist and carbonate schist usually refer to a rock in which there is a high percentage of carbonate of lime, magnesia and iron. The rocks around the Hollinger mine, which are very much altered to schist, are referred to generally as grey schist. They contain considerable "carbonate," sericite, quartz and chlorite. An extreme alteration of an igneous rock to a schist is shown at the "blue" vein of the Millerton to the south of Miller lake. The ellipsoidal structure showing amygdulæ is still preserved, while the rock is a schist quite light grey in color and with a high percentage of carbonate.

Rocks which are probably alterations from basalts are of frequent occurrence in this area. They may now properly be called meta-basalts. A very striking rock is seen on the prominent hill east of the Hollinger mine. The ellipsoidal structure is very conspicuous, being readily recognized from a distance.

There is a series of rocks outcropping in the southwest portion of Whitney, in most of Shaw and the greater part of Deloro township which differs greatly from those which form the large part of Tisdale township. This series consists of fine-grained greyish and greenish schists, some of which show water-sorted

*Extracts from the third report published by the Ontario Bureau of Mines.

bands, rusty weathering carbonate, iron formation, agglomerate, ash rocks, pillow lavas and other igneous rocks. The series contains a high percentage of fragmental rocks, in which respect it is different from the volcanic series in Tisdale. The bands of iron formation occur at different horizons in this series.

A number of green dikes are associated with these rocks throughout Deloro and Shaw. These are usually less than 100 feet in width and they cut the banded iron formation. The rock is completely altered, the predominating mineral being chlorite which gives the green color to the rock.

Iron formation outcrops frequently in the southwest portion of Whitney township and also in Shaw and Deloro townships.

In various parts of the area associated with Keewatin rocks are carbonates to which various terms have been applied, such as: dolomite, ferro-dolomite, ferruginous carbonate and ankerite.

Two series of sedimentary rocks later in age than the Keewatin occur in the Porcupine area. Of these, the older is the Timiskaming series, which is of great importance, while the younger is the Cobalt series, which is unimportant.

The Timiskaming Series.

This series of rocks is prominent in the townships of Tisdale and Whitney. It is traceable by means of infrequent exposures from the vicinity of the Dome mine to the north shore of Night Hawk lake. To the east of Night Hawk lake the country is heavily drift-covered. Sedimentary rocks similar to those of Porcupine are seen in Beatty and Munro townships, which lie to the east of Matheson station, about 40 miles from Porcupine, and again at Kirkland lake where many of the gold-bearing veins occur in schistose conglomerate and greywacke. The rocks of the series are in areas which have their greater dimensions in a general east and west direction, as will be seen from the maps of the Porcupine and Kirkland Lake areas.

The Timiskaming series consists of conglomerates, interbanded slate and greywacke, and quartzite. The rocks for the most part have been altered to schistose derivatives. The beds are in a highly inclined attitude varying from about 70 degrees N. to vertical. The general strike of these beds around the North Dome and nearby properties is about N.E. and S.W. The cleavage planes are quite clearly shown to intersect the bedding planes and are in a more nearly east and west direction. Where the slate-greywacke rocks occur, the original bedding is quite plainly recognized in the alternate dark and light-colored beds. This sedimentary structure is well shown around the North Dome. Here the slate-greywacke beds are lying against a bed of conglomerate about 200 feet in thickness.

The sedimentary rocks at the Dome mine have been greatly altered, occurring as they do along a sheared zone impregnated with quartz. In the large open pit at this mine the fragmental character of the rock can be observed, particularly along the south edge where the rock is a conglomerate. In this conglomerate there is considerable variety of included fragments, such as greenstones of varied types, light-colored quartz-porphry, felsite, sugary iron formation and quartz. The matrix of the conglomerate is now quite schistose, and in some of the freshly broken rock, unless light-colored fragments are present it is difficult to recognize the conglomerate character. To the east of the main hoisting shaft there is some extremely fine-grained slaty

rock which breaks in fissile slabs. This same rock is observed in the easterly workings of the mine.

The rocks of the Timiskaming series have been greatly impregnated with carbonate solutions, so that many of them are now largely carbonate, effervescing freely with acid. In this respect these rocks differ from those of the Cobalt series, which are on the whole fresher and harder rocks.

While there is much evidence pointing to a separate sedimentary series of rocks, the possibility of some of what has been called Keewatin being contemporaneous with the Timiskaming, or of some of the sediments being of Grenville age must be considered. Toward the southwest from the open pit at the Dome mine there is a narrow band of conglomerate which has been mapped as Timiskaming. Much of the material in this band, immediately north of the readily recognized pillow lava and amygdaloidal rock, resembles volcanic fragmental or agglomerate. There is no break, however, between the apparent volcanic fragmental and the interbedded slate and greywacke which occurs along the south margin of the open pit and which can be followed northward for a mile. If the rock above mentioned is a volcanic fragmental and not a true conglomerate deposited on an eroded surface, then there is reason for considering the pillow lavas, fragmental rocks, slates, greywacke and conglomerate as belonging to one series. For lithological reasons it seems preferable to consider the large area of sediments as a separate series. Economically the series of sediments has the same importance as the volcanic series, since it has been subjected to the same gold-bearing vein influences.

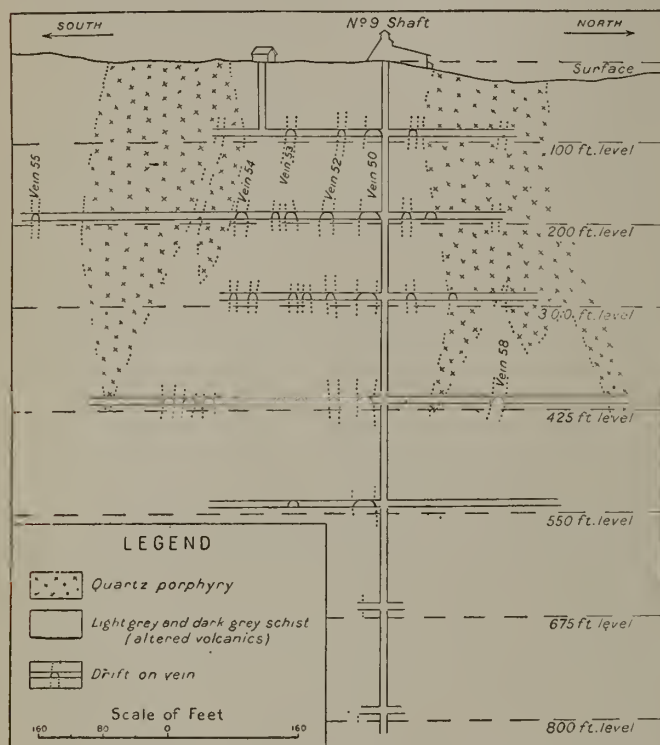
Porphyry.

An intrusive rock, generally of a light grey color, occurs in many parts of the Porcupine area. It is readily recognized in the field by its light color, coarseness of grain, frequent phenocrysts of glassy quartz, and white and bleached phenocrysts of acid plagioclase. In most localities it has been altered to a schist, particularly in the vicinity of the McIntyre, Aeme and Dome mines, but, even when very schistose, it is readily recognized. The rock is quite prominent to the southwest of Pearl lake and to the south of the Dome mine. It occurs sometimes as definite dikes, as at the Dome Extension, where dikes only twenty or thirty feet in width are traceable across a claim. The usual occurrence is in broad, irregular masses which have been exposed by erosion. The outcrops of the porphyry in the vicinity of the Hollinger are elliptical in shape. It is quite likely that other masses occur throughout this area which have not yet been exposed by erosion.

The porphyry is of a light greyish to greenish color. Microscopical examination of the porphyry from numerous places proves it to be fairly uniform in mineral composition. The phenocrysts are quartz and feldspar. Of these the feldspars are much more numerous, and are partly altered to secondary minerals. The groundmass consists of quartz, feldspar, carbonate, sericite, chlorite and pyrite.

Important gold deposits have been found near the contacts of the quartz-porphry and other rocks in Tisdale township, but the contacts of the porphyry and other rocks throughout Whitney and Deloro have not shown ore deposits, although such may be found. It would appear that the intrusions of quartz-porphry at different parts of Tisdale have in some way influenced the deposition or location of the gold, but it is not likely that the porphyry has been the source of the

gold-bearing solutions. The porphyry has been subjected to extreme alteration in the zone of vein formation, and has been greatly contorted before the formation of the quartz deposits, which frequently occur in the porphyry as veins or replacements.



A North and South vertical section across the vein system of the Acme mine, illustrating the "chonolith" form assumed by the quartz-porphyry

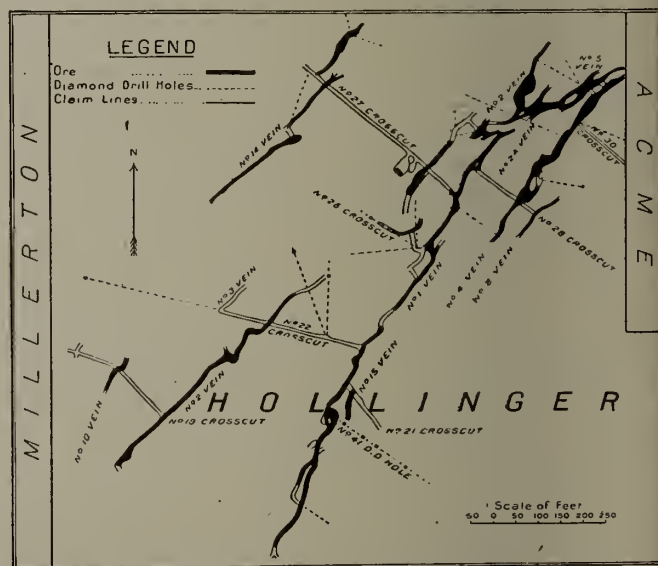
Character of the Gold-Bearing Deposits.

All the gold deposits at Porcupine are believed to belong to the same period of ore deposition. They occur in rocks of Keewatin, Timiskaming, pre-Algoman and Algoman age, while the mineralization was probably in Algoman times. Some writers on this area have attempted to make a classification based on structural resemblance in certain of the deposits. It may be said that each deposit has peculiarities of its own, but that in general there are characteristics common to all. For example, all the deposits will in parts show such structures as simple vein, lode, irregular masses of quartz, and mineralized schist. These structures are largely dependent on the character of the enclosing rock, whether schistose, greatly foliated, or massive. Some deposits have been formed near the contact of the quartz-porphyry with other rocks, but this feature is not sufficient in itself to warrant such deposits along contacts being classified separately. For example, at the Dome mine the deposit exposed in the large open pit is considerably north of the contact and in the conglomerate and slate, whereas a deposit underground to the south of No. 2 shaft and only a few hundred feet away has the quartz-porphyry as the hanging wall.

The irregular fissuring has produced a great variety of quartz structures, varying from the tabular, though often irregular or lenticular, vein which may be traced several hundred feet, to mere veinlets, often only a fraction of an inch in width and a few feet in length, which ramify through a rock that has been subjected to small irregular fissuring. This latter variety is well

illustrated in the fissuring of ankerite bands, so characteristic of some of the gold deposits of Porcupine. Irregular and lenticular bodies of quartz often occur which may have a width of ten or twenty feet, but which die away in a distance of fifty feet. Again, there are dome-like masses of quartz which are elliptical or oval in surface outline. In some parts at least these masses can be seen in contact with underlying rocks at a low angle, which would suggest that they are broad lenticular masses which have filled lateral fissures in the country rock. The most conspicuous dome masses were those of the Dome property, where the two largest were about 125 feet by 100 feet. A fissure may be vertical and irregular at some points. At others it may incline at a lower angle to the horizontal or take on a more or less lenticular form.

The term "vein" as used here is not confined to the filling of a single fissure with well-defined walls, for this type of vein is rather the exception in the Porcupine area. The fissuring has been so irregular that a "vein" in one part may consist largely of quartz, and in another part of numerous veinlets of quartz and intervening schist, greatly resembling a stockwork; again, the main part of a vein may be almost vertical in attitude, but many veinlets, as branches from the main vein, may extend laterally into the country rock. It is often found that the values are obtained in parts of the vertical vein which have been subjected to a later movement and enrichment, whereas the lateral veins have little or no value. This is illustrated in the No. 1 vein at the Rea mine.



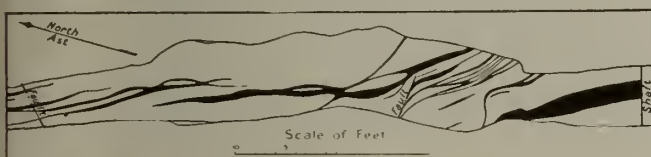
Plan of the 200 foot level, Hollinger Gold Mines, Limited

The relationship of the strike of the veins to that of the enclosing rock is often difficult to determine, since generally along the veins there has been shearing of the country rock which may conform to the general direction of the strike of the veins. However, by determining numerous strikes in the schist away from the veins, it is seen that the majority of them are inclined to the strike of the enclosing rocks. In dip the veins vary from vertical to nearly horizontal. In No. 1 shaft of the Hollinger the vein is practically vertical, while a series of narrow quartz veins, 6 to 18 inches wide on the Lindburg claim, have a dip at the surface of only 20 degrees. The prevailing dip of the schist in the Porcupine area is to the north at a high angle, and frequently the veins dip distinctly to the south across

the cleavage of the schist. While it is apparent that most of the deformation of the country antedates the vein formation, nevertheless there is a decided tendency in many cases for the fissuring to be influenced by the direction of schistosity, which is also a direction of weakness; hence we find veins having a more or less lenticular structure, the strike of which closely corresponds to that of the country rock.

It will generally be found that where the lenses are broad the schistose wall rock is approximately parallel with the lens; whereas the narrow portions of vein between lenses frequently cut across the schist.

Lenticular veins occur chiefly where the country rocks have been intensely sheared or rendered schistose, as around Pearl lake. Usually when there has been less disturbance the veins are more likely to have a marked difference in strike from the enclosing rock—as around Three Nations lake and the porphyry area south of Simpson lake. It may be stated that the larger and usually lenticular veins of the area occur where the rocks are extremely schistose, while the narrower, better defined veins occur as stringers from these main lenticular veins, or in less disturbed areas.



Plan of the 50-foot level, Porcupine Pet, H.R. 907, Deloro Township, showing the reticulated structure of the auriferous quartz veinlets in the quartz-porphry.

The quartz-porphry on the Preston, Fogg (L.O. 325) and other claims in Deloro township along its north boundary is more massive than that near the Dome or around Pearl lake, while the greenstone is also much less altered to schist than in other parts. Consequently the veins are narrower and have not the lenticular structure so characteristic of those deposits at Porcupine which are in schistose rocks. Most of these veins have a strike nearly north and south across the mass of

solutions, difficulty has been experienced in finding ore-bodies of commercial importance.

Distribution of Veins.

While gold-bearing veins occur over a wide area and are often isolated, it is seen, from a number of those already discovered, that they occur in groups along certain lines. For instance, in Tisdale township there are at least three distinct areas where the fissuring has been most pronounced. One such area extends from the southeast end of Miller lake, on lot 11, in the second concession, in a northeasterly direction for three miles, and includes such veins as the Porcupine Crown, Millerton, Hollinger, Acme, McIntyre, Jupiter, Rea, and in addition others with visible gold. The average strike of the veins here is northeast and southwest. An exception is a vein on the Porcupine Crown, which strikes north and south.

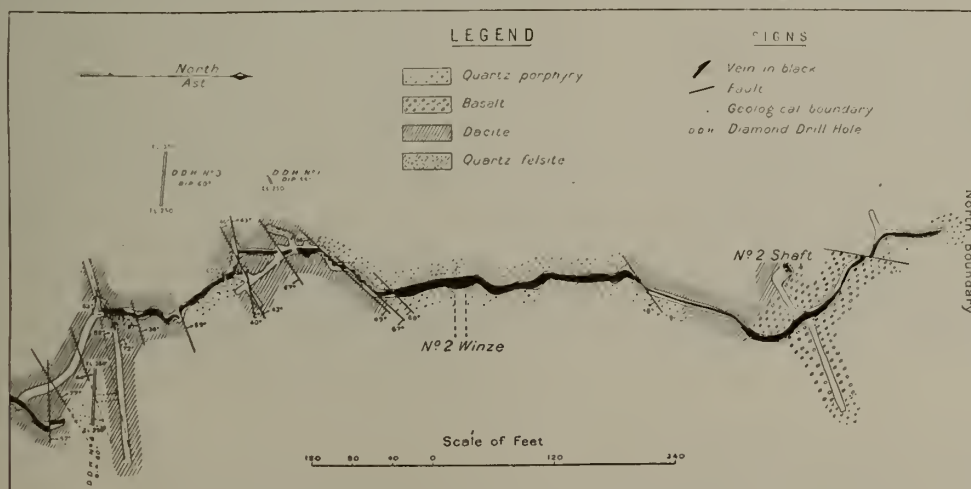
Another series, including the Smith, Davidson, Crown Chartered and Dobie, occurs in the northeast part of the township. To these should be added the Scottish Ontario, Mullholland, Hughes and Gold Reef, which are in the northwest part of Whitney township. The general direction of these veins is east and west.

Again, in the southeast part of the township is a group including the Dome Lake, West Dome, Dome and Dome Extension, with a general strike north of east.

Occurrence of the Gold.

A field examination shows that there is an irregular distribution of the gold in the quartz veins. Very often it occurs along dark streaks in the quartz, along the contacts of quartz and schist, or around patches of dark colored mineral in the quartz. At the surface, rich portions of veins are often indicated by rusty streaks or patches, while at depth the rusty character gives place to dark grey, black or greenish colors.

Under the microscope the gold is generally found in areas which have been greatly crushed or in the quartz or schist bordering on these areas.



Plan of the third level (300 feet) Porcupine Crown mine, showing geology and intricate block and step faulting to which the vein has been subjected. The reproduction is from plan furnished by M. W. Summerhayes, manager.

quartz-porphry. They lack the banded structure so frequently seen in the Pearl Lake area. Coarse gold associated with zineblende and pyrite occurs in some of the narrow veins, many of which are only a few inches in width. Owing to the narrowness of these rich veins, and the massive character of the porphyry rock which shows little impregnation with gold-bearing

The prominent minerals which occur in the crushed areas are pyrite, calcite, dolomite, sericite, chlorite, tourmaline and quartz. It is thought that most of the gold has been deposited along with pyrite from the impure solutions which circulated in the minute fissures and crushed areas of the primary quartz of the veins. The quartz of No. 1 vein of the Hollinger mine shows

numerous dark streaks in parts of it and often across the width of the vein. These are generally short and irregular in distribution. Iron pyrites and often galena occur with the gold. Microscopically, the quartz occurs in fairly large grains, contains liquid and gas inclusions and has been subjected to secondary pressure and granulation along the margins of the grains. The iron pyrites often occurs in well-shaped crystals which have been formed subsequent to the crushing. These fine dark streaks may have resulted from a solidification and shrinkage of the quartz forming filmy cracks, which may have become slip or crushing planes along

showed grains of gold apparently enclosed in the primary quartz, but the occurrence is much less prominent than where gold occurs in the crushed areas.

It is important to note that practically all the veins which are gold-bearing contain considerable carbonate of varied composition. Wherever the enclosing rocks are of schistose they always carry carbonate.

MUNRO TOWNSHIP

While the road into the Munro township goldfields is now in such a condition that it is hard to get in supplies save at night when the frost has stiffened the mud, there is every indication that there will be much activity in the townships of Munro, Beattie and perhaps Bowman.

It is upon the success of the Croesus that everything turns, and it is narrowly watched. The plant at the Croesus is now complete with the exception of the headframe, which was started this week. At the 100 and 150-foot level some of the high grade is being broken down and two shipments of bullion have been made to Denver—one during the past week. The shaft is being sunk to the 400-foot level, and at the end of last week it was down 340 feet, with the vein in the bottom of the shaft. All location in the district is announced in the camp in relation to the position of the Croesus mine. All the properties mentioned later, have some free gold, although there is little work done.

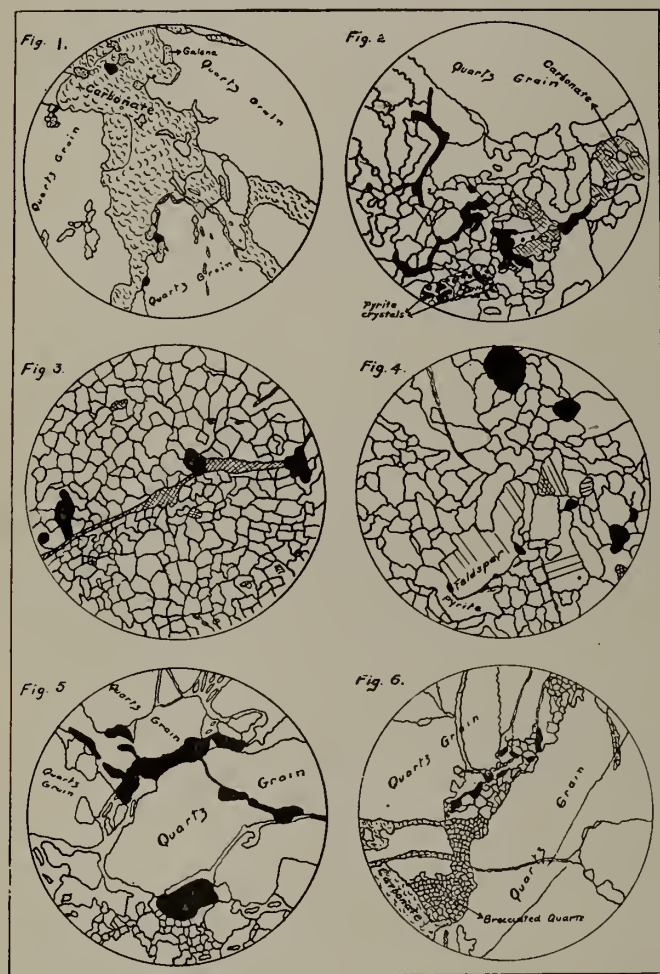
On the Falkenham property, north of the Croesus, a shaft is being put down. Mr. E. A. Taylor, of Toronto, is sinking a shaft on the Daniels veteran claim about a mile and a half east of the Croesus. The shaft is now down about 25 feet. Mr. Mickle, of the firm of Mickle and Dymont, of Barrie, is putting up camps on a claim in Beattie and preparing to sink. Mr. John McLaughlin, whose property is situated about three-quarters of a mile east of the Croesus, is sinking in the porphyry.

Mr. Chas. Miller, of Toronto, who is the president of the Burton mines, says that his company will certainly do something on the claim this year, although there is actually nothing doing now. The Munro Consolidated will start work as soon as the Hairston estate is wound up. The Brown veteran claim will be explored as soon as the weather is better, and there are many other properties that were staked last year but abandoned when the road became so bad.

If nothing is done to the road this spring it will degenerate into a mud wallow which will make transportation most expensive and will have the effect of keeping capital out of the country. It will be difficult enough to travel if the summer proves to be a dry one, but if it is wet it will be the worst road in Northern Ontario.—Northern Miner.

HOLLINGER EXTENSION.

On the Hollinger Extension, about 300 feet from the northeast corner of the Vipond, the Canadian Mining and Finance Co. are now sinking shaft No. 14. At the 425-foot level a crosscut 2,500 feet long will connect this shaft with the central deep working shaft near the southwest corner of the Acme and consequently with the extensive workings on that property and on the Hollinger and Millerton. Shaft No. 14 is in the zone of coarse-grained siliceous lava as lately mapped by A. G. Burrows, and extending across the Acme, Hollinger Extension and Porcupine Success.—Cobalt Nugget.



Drawings of thin sections of ore from Porcupine quartz veins. Fig. 1, Hollinger. Fig. 2, Dome. Figs. 3 and 4, Porcupine Lake. Fig. 5, Rea. Fig. 6, Vipond. Black spots are native gold.

which the richer gold-bearing solutions were deposited at a later period. These minute dark streaks in the quartz are frequently slickensided, and this character may often be seen in hand specimens, as from Rea or Vipond mines.

Often a vein may show a width of ten feet, but the fractured portion may be only a few feet, or even inches, wide along either wall. In this portion there may be many streaks of dark mineral which are often parallel, giving a banded character to the ore, as in many of the veins in the north part of Whitney and Tisdale, namely, at the Mullholland, Scottish Ontario, Davidson and adjoining properties. A similar banded structure is seen at the Rea mine. At these properties tourmaline is the principal mineral of the streaks. The gold may occur along these lines or in the intervening quartz, which is often much crushed and filled with later minerals. Several sections were examined, which

THE TREATMENT OF PORCUPINE GOLD ORES

Poreupine, being the most important gold distriet discovered in recent years, has received the attention of many of the best metallurgists. From their studies it was soon evident that the ores would be comparatively

suitable for treatment by the proecess became a more important factor amalgamation was discarded. The first Hollinger mill was destroyed by fire before it was completed. The McIntyre and Vipond mills were shut down after being operated for some months. The Hollinger, McIntyre and Vipond now use the cyanide process.



Porcupine Crown cyanide plant



Ball and tube mills, McIntyre plant

easy to treat. The ores are very easily crushed, a considerable portion of the gold in some of the ore is readily recovered by amalgamation and the gold not easily won by amalgamation can be recovered very economically by cyanide treatment.

In the mills first built amalgamation played an important part in the treatment. Hollinger, McIntyre and Vipond all had small mills in which amalgamation was the chief method of recovering the gold. These proved satisfactory for some of the ore, but as ore un-

At the Dome, cyanidation has been used from the start. At first the ore was passed over plates before fine grinding, but later the primary plates were discarded. At present amalgamation is used in treating concentrates from cone classification of the tube mill product.

Present practice at Poreupine is to crush the ore by stamps or ball mills and recrusher in tube mills. The primary crushing in most cases is done in solution. Dome, Hollinger and Poreupine Crown use stamps. Mc-

Intyre and Vipond use ball mills. Ball mills and stamps give splendid results. The ore can be easily crushed with either. There is, however, considerable difference of opinion as to the relative merits. Many express themselves in favor of ball mills. The McIntyre has certainly obtained excellent results from their use. On the other hand the stamps have done good work. Apparently the available data is not of a character to justify a change being made in existing plants nor is it even conclusive enough to lead to an easy decision on the part of those who are planning new plants and additions. At the Dome and Hollinger ball mills have been installed as an experiment. The results obtained in the next few months from these tests will undoubtedly have considerable influence on the design of new plants for the treatment of such ores.

Next to the crushing problem, perhaps the most interesting feature of Poreupine metallurgical practice just now is the adaptability of continuous counter-current decantation. The process has proven very successful.



Tube mills, Hollinger plant.

Last year Mr. Noel Cunningham presented a paper at the Toronto meeting of the Canadian Mining Institute on "Metallurgical Practice in the Poreupine District." The following are extracts from his paper:

"Character of the Poreupine Ore.—There is no oxidized ore in the district, the surface having been deeply planed by glacial action in recent geologic time. The precious metal content is about in the proportion of 85 of gold to 15 of silver by weight; hence, the silver is practically negligible. There are two classes of Poreupine ore, having very different characteristics; these will be referred to throughout this paper as Class A and Class B.

"Class A ore is a pure quartz with inclusions of schist. Generally it is heavily fractured and breaks down readily to sharp, hard grains, about minus 10 plus 20 mesh, requiring further comminution to release the gold. It carries very little pyrite; the gold is entirely free and apt to be coarse, but often spongy, going into solution readily on that account. This gold is 60 per cent. to 85 per cent. free milling, depending on the grade of ore.

"Class B ore is a schist, strongly laminated, carrying 4 to 5 per cent. pyrite; its specific gravity is 2.8 to 3.0, depending upon the amount of mineralization. In breaking the ore in the mine, generally over 25 per cent. of material through a 1/2-inch ring is made; the ore readily breaks down in milling and makes a comparatively large amount of non-crystalline slime; ow-

ing to its high specific gravity, however, it is quick settling. In my opinion, the gold in this ore is free, but so finely divided that it will neither pan nor amalgamate; it appears to be disseminated through the rock and not chiefly associated with the pyrite.

"Mill Design.—The proper design for a mill treating Poreupine ore will depend upon the proportions of Class A and Class B ore to be handled. Unless there is to be a large excess of Class A ore, amalgamation may be dispensed with, as the recovery by amalgamation will not warrant its use. If Class A ore is in large excess it would still be an open question, but from a recovery standpoint amalgamation is unnecessary.

"The Hardinge ball mill may not show up as well on Class A as on Class B ore, but I am inclined to think that it would. With an excess of Class B ore the ball mill will be superior to stamps. I am of the opinion that a cylindrical tube mill should be used for fine grinding, rather than a conical mill, if only for a theoretically better dissolution of coarse gold. For the treatment of any considerable proportion of Class B

ore, table concentration, with separate treatment of the concentrates, will probably pay.

"Agitation should be arranged to be continuous, preferably in a series of flat-bottomed agitators, allowing a preferential treatment for the quicker-settling portion of the ore. If filtration is used, a pressure filter will be more satisfactory than a vacuum filter; however, the ore is so perfectly adapted to continuous counter-current decantation that this would seem to be the proper treatment.

"On account of the severe winter conditions and the high cost of fuel, the object to strive for in the design should be as compact an arrangement of the equipment as possible, so as to minimize the cubic area of buildings to be heated. In the district, the water supply is ample, the sites for mills are good, and the facilities for convenient tailing disposal are adequate."

CHAMBERS-FERLAND.

In running a crosscut from the winze on the Chambers-Ferland at the 425-foot level what is undoubtedly an extension of one of the veins of the Meyer system has been cut. It is from two to four inches of very high grade ore where it is cut about 180 feet from the winze, but it is right on a fault and some development will have to be done before its importance can be accurately defined. At the point struck it is about 59 feet from the Nipissing line. The discovery at its present stage of development is of much promise.—Northern Miner.

METALLURGY AT TOUGH-OAKES GOLD MINES, LIMITED

By Chas. A. Randall.

The Tough-Oakes Gold Mines, Ltd., is the chief producer in the Kirkland Lake gold mining area, which is about 60 miles north of the Cobalt silver mining district, in the Province of Ontario. The plant for treatment of the ore is one of the most recently constructed in Ontario. It has now been in continuous operation over one year.

During May, 1913, a small amalgamation mill was put into operation, primarily for producing revenue from that portion of mine ore which was not shipped to smelters direct. The small mill, consisting of five stamps and an amalgamation table, was subsequently increased in size by the addition of a Hardinge pebble mill. This amalgamation mill was operated until March, 1915, and gave an average recovery of about 50 per cent.

In May, 1914, metallurgical experiments were begun for the purpose of deciding upon the most suitable type of cyanide plant for handling the average run of mine ore. The following tests are representative of results obtained, and indicated that with a grinding of ore product 75 per cent. to pass a 200-mesh screen, and an agitation in cyanide solution of twenty-four hours' duration, it would be possible to get an extraction around 94.5 per cent.

Amalgamation tube mill and tank agitation test on 40 pounds of stoping ore, principally porphyry and quartz.

In this test the concentrates were not separately ground to pass 200-mesh, but were separated from bulk of ore, sampled and then added to the sands subjected to tube mill treatment. Old precipitated solution, having a head value of 1.45 pounds KCN per ton of solution, was used.

Assay heads of ore under treatment, \$41.40.

Assay head sands and concentrates to tube mill, after amalgamation, \$16.20.

Assay tails tube mill, \$6.40.

Extraction on \$16.20 head, 60.49 per cent.

Head assay slimes (to tank 1 hour), after amalgamation, \$18.30.

Tails assay slimes (to tank 1 hour), \$3.80.

Extraction on \$18.30, 79.82 per cent.

Calculation of composite heads to grinding circuit:

63% (sands and concentrates).....\$16.20 = \$10.20

37% slimes (to tank 1 hour)..... 18.30 = 6.77

\$16.97

Calculation of composite tails from grinding circuit:

63% tube mill tails..... \$6.40 = \$4.03

37% slimes tails (1 hour)..... 3.80 = 1.41

\$5.44

Assay original heads.....\$41.40

Assay to grinding circuit..... 16.97

Extraction by amalgamation.....\$24.43 = 59%

Grinding circuit head.....\$16.97

Grinding circuit tail..... 5.44

Cyaniding extraction on \$16.97 head...\$11.54 = 68.8%

The following table shows results by taking samples from discharged air lift:

Time, Hours.	Tails Assay from Air Lift.	KCN used per ton.	Cyanide extraction on \$41.40 Head.
			Per cent.
0	\$5.44	.54	87.10
1	4.40	.75	89.37
4	2.40	.9	94.20
7	2.20	.9	94.68
10	2.00	.95	95.17
13	1.90	.95	95.41
20	1.90	.95	95.41
24	1.80	1.1	95.65
30	1.80	1.1	95.65
Final residue	2.30	1.1	94.44

Screen tests:

Original ore—	Per cent.
On 80 mesh.	29.2
On 100 mesh.	12.5
On 150 mesh.	7.4
On 200 mesh.	12.2
Through 200 mesh.	37.2
	98.5

Head Assay..... \$41.40

Final residue—	Per cent.
On 150 mesh.	6.5
On 200 mesh.	15.4
	77.3
	99.2

Tube mill and tank agitation test on 60 pounds sample of stoping ore averaging about three-fourths porphyry and one-fourth greywacke and conglomerate, and some quartz.

Ratio of ore to solution in tube mill, 1 to 1½.

Heads assay sands to tube mill, \$36.20.

Tails assay residue from tube mill, \$5.40.

Tube mill extraction, 80.51 per cent.

Ratio of slimes (to tank 1 hr.) to solution, 1 to 4.

Head assay slimes, \$48.40.

Tails assay slimes, \$4.20.

Extraction, 91.70 per cent.

Pounds of sands to tube mill, 30.

Pounds of slimes to tank, 30.

Heads assay combined sands and slimes, \$42.30.

Tails assay combined after above treatment, \$4.80.

Overall extraction after above treatment, 88.65 p.c.

Screen tests:

Sands to tube mill, 30 lb.—	Per cent.
On 60 mesh.	7.8
On 80 mesh.	66.2
On 100 mesh.	23.4
Through 100 mesh.	2.4
	99.8

Assay value..... \$36.20

Slimes to tank, 30 lbs.—	Per cent.
On 100 mesh.	29.0
On 150 mesh.	2.3
On 200 mesh.	3.6
Through 200 mesh.	65.0
	99.9

Assay value..... \$48.40

Combined sands and slimes before treatment—

	Per cent.
On 60 mesh.	3.9
On 80 mesh.	33.1
On 100 mesh.	26.2
On 150 mesh.	2.3
On 200 mesh.	1.8
Through 200 mesh.	32.5
	99.8

Combined sands and slimes after above treatment subjected to 24 hour agitation with paddles and air lift.

	Per cent.
On 150 mesh.	8.2
On 200 mesh.	7.0
Through 200 mesh.	84.4
	99.6

Assay value of ore heads, \$42.30.

Assay value of final residue, \$2.10.

Overall extraction, 94.90 per cent.

The following table shows the results obtained from samples taken from discharge of air lift during the 24 hours' agitation period.

Hours.	Assay value residue.	KCN used per ton ore—lb.	Overall extraction Per cent.
0	\$4.90	.8	88.65
3	3.40	1.1	91.09
6	3.20	1.1	92.43
9	3.00	1.2	92.90
12	2.70	1.3	93.61
16	2.20	1.4	94.80
24	2.10	1.5	95.04

Strength of KCN solution used, 1.5 lbs. per ton solution.

Specific gravity final slimes, 2.7.

Rate of settling, 500 c.c. graduated cylinder used:

Clear Solution.	Time.
10 per cent.	2 minutes
20 "	3½ "
30 "	5 "
40 "	9 "
50 "	14 "
55 "	21 "
60 "	25 "
65 "	30 "
70 "	45 "
75 "	85 "

Concentration, tube mill and tank agitation test on 40 pounds of stoping ore, principally porphyry and quartz.

After concentrating, all sands coarser than 200 mesh, amounting to about 63 per cent. of the whole charge, was given tube mill treatment. The 37 per cent. under 200 mesh was passed to agitation tank direct. In previous tests of this series all on 150 mesh was passed to tank direct. In panning concentrates all heavy sands which tended to remain with the concentrates were retained as such. The strength of KCN used was 1¼ pounds per ton of solution. The ore head used had an assay value of \$41.10.

Screen test of ore before treatment:

All through 60 mesh—	Per cent.
On 80 mesh.	29.2
On 100 mesh.	12.5
On 150 mesh.	7.4
On 200 mesh.	12.2
Through 200 mesh.	37.2
	98.5

Grams of concentrates recovered, 291.3.

Percentage of concentrates by weight, 1.604.

Pounds of concentrates per ton ore, 32.08.

Assay per ton concentrates, \$1,658.80.

Value of concentrates in 1 ton ore, \$26.13.

Percentage extraction by concentration, 63.58.

Assay original heads, \$41.10.

Concentrates extraction, \$26.13.

Calculated assay head after concentration, \$14.97.

Assay value of sands after concentration, \$15.90.

Assay value of slimes after concentration, \$12.20.

Assay value of sands after tube mill and slimes to tank 1 hour, \$2.40.

Extraction on \$14.97 head in grinding circuit, 83.97 per cent.

Assay value final residue after 30 hours' agitation, \$1.60.

Total cyanide extraction on \$14.97 head, 89.31 per cent.

Overall extraction by concentration and cyanidation on \$41.10 head (assuming 100 per cent. extraction on concentrates), 96.11 per cent.

The following table shows extraction during tank agitation:

Time.	Assay value.	KCN used.	Extraction on \$14.97 head.	Overall extraction on \$41.10 head.
0	\$2.40	.08	83.97	94.13
3	2.20	.12	85.30	94.64
6	2.20	.16	85.30	*
9	1.70	.48	88.64	*
12	1.70	.48	88.64	*
15	1.60	.48	89.31	*
21	1.75	.48	88.64	*
24	1.50	.48	89.98	96.35
30	1.40	.48	90.65	96.60
Final residue	1.60	.48	89.31	96.11

* Assuming 100 per cent. extraction on concentrates.

Note.—KCN used with concentrates in pulp was about 1.3 pound per ton ore during this treatment.

Treatment of Concentrates.—The 291.3 gms. of concentrate was thoroughly rolled on mixing cloth. A one-fifth portion was taken and ground to pass 200 mesh screen. A duplicate head assay sample was taken and the remainder subjected to cyanide bottle agitation treatment.

The other four-fifths of the concentrate were given a screen test and from each portion a sample was taken and the remainder subjected to cyanide treatment. In addition a "through 200" mesh product of the concentrate from a previous test was given a wash for 8 hours in a 1 per cent. sulphuric acid solution, and then passed to cyanide treatment.

Strength of cyanide solution used in treatment of concentrates, 4.55 pounds per ton solution.

Time of cyanide treatment, 40 hours.

Concentrates 291.3 grams. Test (16-8).

Mesh.	Per cent.	Assay value	Proportionate	Tails assay	Extraction	KCN used	CaO used
		per ton.	value per ton.	per ton.	per cent.	per ton. Lbs.	per ton. Lbs.
80	29.89	\$2,048.80	\$612.39	\$18.80	99.08	17.6	16.5
100	12.79	.....	.....	.....	.....	....	....
150	12.48	1,737.60	439.09	16.80	99.03	20.4	19.3
200	26.73	887.60	237.25	16.00	98.19	18.3	17.6
Through 200	17.79	2,257.60	401.63	51.20	97.73	31.6	30.6
Through 200	composite	1,658.80	.....	12.80	99.20	18.6	20.5

Concentrates. Test (16-7). Acid treatment before cyanidation.

Through 200	\$1,448.00	\$36.80	97.45	20	15
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Note.—In acid treated concentrates the whole of the KCN and CaO was decomposed, which condition doubtless affected the extraction.

Gold per ton ore in final pulp residue—98.4
per cent. of \$1.60..... \$1.57
Gold per ton ore in final concentrate residue—
1.6 per cent. of \$12.80..... .20

Calculated overall assay final residue..... \$1.77
Overall extraction on \$41.10 head..... 95.7 per cent.

Cyanide consumption—

98.4 per cent. of .48 lbs. KCN = .47 lbs. per ton
1.6 per cent. of 18.60 lbs. KCN = .28 lbs. per ton
—
.75 lbs. per ton

Screen test of final residue:

All through 100 mesh— Per cent.
On 150 mesh. 7.2
On 200 mesh. 13.0

Through 200 mesh. 79.3

99.5

Assay value \$1.60. Sp. Gr. 2.7.

Settling test:

Clear Solution.		Time.
20	per cent.....	8 minutes
50	"	30 "
57	"	40 "
60	"	45 "
68	"	60 "
71	"	82 "
72	"	90 "
73	"	97 "
74	"	110 "



Tough-Oakes Mill, Kirkland Lake, showing ball and pebble mills

Character of Tough-Oakes Ore.

The average run of milling ore consists of about 75 per cent. hard tough porphyry and quartz, and 25 per cent. of softer greywacke and conglomerate. The ore carries about one per cent. of concentrates which with free gold removed has an assay value of about \$250 per ton, and with free gold not removed \$1,000 to \$1,600 per ton. Some of the gold is coarse and approximates about 1.5 per cent. of the total gold recovery, but in general it is fine, occurring in the quartz, associated with sulphides and tellurides, and finely disseminated throughout the wall rock adjoining the vein proper.

The Cyanide Plant.

The construction of the 100-ton cyanide plant was begun in the fall of 1914, and actual milling began March 15th, 1915.

Elevating and Crushing.—The ore is delivered from the main shaft to the mill bin by a skip of 1½ tons capacity. From the mill bin the ore discharges to a 12 by 20-inch Buchanan crusher, with opening set at 2 inches. From this crusher the ore is hoisted by bucket elevator to a 30-inch by 60-inch Gates-type revolving screen having 1½-inch circular openings. The oversize of this screen goes to a 10-inch by 16-inch Buchanan crusher, set at 1¼-inch opening, and then returns to the screen by the same bucket elevator. From the trommel screen the undersize falls to a 14-inch conveyor belt which delivers it to the crushed ore bin of 150 tons capacity.

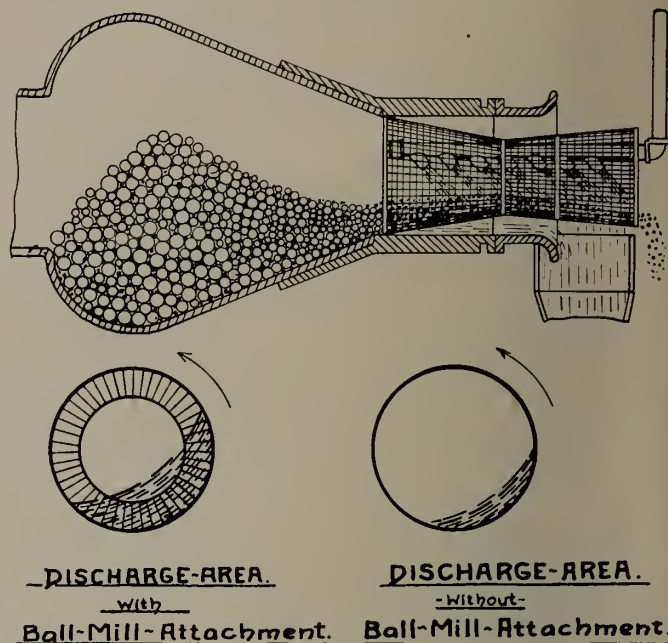
Ball and Tube-Mill Circuit.—The ore is discharged from the crushed ore bin by three eccentric plunger feeders on to a 14-inch conveyor belt leading direct to ball mill feed box. The Hardinge ball mill is 6 feet in diameter and operated at a speed of 29 r.p.m.



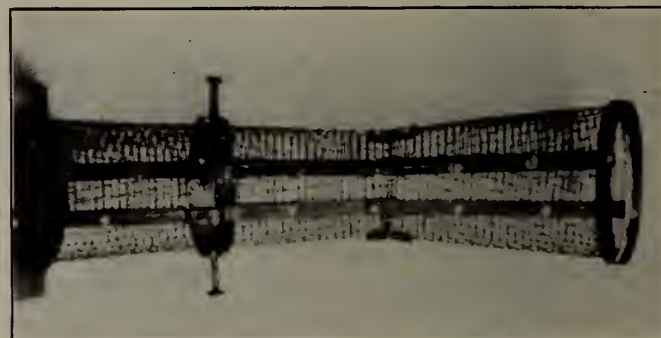
View of discharge end of ball mill showing screen attachment

During the months of May, June and July, 1915, under normal power conditions, and with ball load varying from 4 to 4½ tons, the average tonnage treated in the ball mill for total time was 82.68 tons, and for actual running time 90.62 tons per day, with a total power consumption of about 43 h.p. On August 1st a ball mill attachment was installed, with a result that all oversize going to the tube mill circuit was eliminated, the ball load was increased nearly 30 per cent. and the required power necessary to drive the mill reduced to 37 h.p. During the five following months the tonnage delivered to the tubes through a ¾-inch opening and approximating 75 per cent. through ¼ mesh was for total running time 102.27 tons, and for actual running time 110.41 tons per day.

This shows over an eight months test a tonnage increase of over 25 per cent., and a total decreased power consumption per ton of ore treated of 28.1 per cent. The ball consumption decreased from 2.4 lb. to 1.8 lb. per ton of ore, and the life of ball mill lining has increased from four months to seven months. The ball mill attachments permit of a rapid removal of any oversize particles at or near the discharge opening of the ball mill, thereby permitting it to be discharged, classified and returned to the head end or zone of maxi-



DISCHARGE-AREA. with Ball-Mill-Attachment. DISCHARGE-AREA. -Without- Ball-Mill-Attachment.



Screen attachment for ball mill.

mum crushing efficiency, and at the same time by its removal giving a more free and rapid discharge of sufficiently ground pulp with a minimum of slime.

The undersize product from the ball mill discharges on a trough screen of ¼-inch mesh, the oversize from which is forced by a jet of solution down through a centre channel of an amalgamation table, on either side of which are strips of cocoa matting. The fines passing through this trough screen pass over the cocoa matting. By aid of this matting and traps at the foot of the table coarse gold is collected amounting per month to from \$800 to \$1,500, depending for the most part on the value of the ore heads to the mill. The weight of the largest pieces recovered in this manner varies from 1 to 6 dwt.

The discharge from the foot of the table goes direct to the first duplex Dorr classifier, which together with the first tube mill is in series with the second duplex classifier and tube mill. The tubes are 5 feet by 20 feet,

and fitted with the Globe type liners. By removing the perforated disc at the discharge end of the tube mills and replacing them with an attachment similar to that used in the ball mill, but of smaller mesh openings, a more rapid discharge was obtained, as well as an easy method of removing from the grinding circuit an accumulation of undersize pebbles, or oversize ore. Before the attachment was installed in ball and tube mills the average pebble consumption was about 16 pounds per ton of ore treated. The pebble feed at the present time is less than 4 pounds per ton of ore. Chunks of hard porphyry ore are also added, approximating 3 pounds per ton of ore.

Cyaniding.—The cyanide plant consists essentially of one 30-ft. by 10-ft. steel primary Dorr thickener, working in series with three agitators 16-ft. by 12-ft., followed by four 28-ft. by 10-ft. Dorr thickeners. The pulp from the classifiers flows into No. 1 thickener at 85 per cent. moisture. The overflow from this tank is the "pregnant solution" and has an average value of about \$3.50 per ton. The underflow is discharged into the agitation circuit at a moisture content around 44 per cent. The average value of solids to agitator circuit is \$4, which on an original average ore head of \$22 gives an extraction in grinding circuit approximating 82 per cent. The moisture content during agitation is maintained at about $2\frac{1}{2}$ of solution to 1 of ore. In the first agitation the cyanide strength in total cyanide is maintained at 3 pounds per ton of solution. Enough lime emulsion also is added to keep the alkalinity in terms of CaO at 1.5 pounds per ton of solution. The pulp going to the agitators is diluted entirely with crushing solution which has a cyanide content of 2.5 pounds and a CaO content of 1.2 pounds per ton of solution. The solids from the agitators have an average value of about \$2.20 per ton.

From the third agitator the pulp flows into thickener No. 2. The overflow solution of this thickener discharges into a lower crushing solution tank and carries an average gold value of \$1.20 per ton of solution. The underflow pulp is drawn by diaphragm pumps through the remaining thickeners with a moisture content of about 44 per cent. The solids discharged from the last thickener give an average assay of \$1.20 to \$1.40 per ton. The dissolved gold loss varies between 15c and 20c per ton. A fourth agitator is now under construction, by aid of which it is expected there will result an increased extraction and decreased dissolved gold loss.

The barren solution from the precipitation presses is delivered to thickener No. 4, a small portion going to thickener No. 5 if dissolved gold loss is tending to be high; a condition most pronounced when the porphyry content of the ore is above the average.

Precipitation.—Zinc dust is used as a precipitant, and is fed into the suction of an Aldrich triplex pump by a Merrill zinc feeder. The emulsified dust and pregnant solution are raised to two 36-inch Merrill precipitation presses. During the first six months' operation of the mill the presses were run alternately for periods of 15 days. In starting up a press the zinc feed was set at about .2 lbs. per ton of solution, and 10 additional pounds of zinc were fed by hand. The average zinc feed over each 15-day period approximated .195 per ton of solution and gave a resultant precipitate around \$35 per pound. In October precipitation experiments were begun with two objects in view; that of determining the curve of minimum zinc feed, and the elimination of acid treatment of precipitate.

The result of these experiments has led to the following practice:

Both presses are started on the first of the month on a zinc feed of .2 of a pound per ton of solution. To each press, as it is started, 10 additional pounds of zinc is fed by hand. During the first two days the barren assay around 4c, on the third day 2c, and on the 4th day 2c, and under. During the next ten days there is an average decrease of one-half point per day in zinc feed, so that on the 15th of each month the zinc feed is about .150 pound per ton of solution. Should the presses be cleaned up on the 15th this means that the zinc feed must immediately be increased to .2 of a pound, which on a solution feed of 500 tons per day means an immediate increase of 25 pounds of zinc per day. From the 15th of each month to the end of the month the rate of decreasing zinc feed becomes slower, else there results an impoverishment of zinc in the presses, and a resultant increase in assay value of the barren solution. By careful manipulation the zinc feed at the end of each month is generally around .130 pound per ton of solution precipitated. In this manner the average monthly feed has been reduced to .165 pound per ton of solution, amounting to a saving of over 400 pounds of zinc per month.

When using an average zinc feed of .195 pound per ton of solution the average value of precipitate recovered averaged about \$35 per pound. The resultant precipitate with an average monthly zinc feed of .165 pound per ton of solution averages about \$78 per pound, and the quantity recovered is reduced in bulk about 50 per cent.

The precipitate having a moisture content of about 40 per cent. when taken from the presses is removed direct to a steam drying pan in the melting room where its moisture is reduced to about 5 per cent. in 36 hours. No acid treatment is given precipitate owing to much reduced zinc contents. After drying it is mixed with fluxes in the drying pan in the following proportions:

	Pounds.
Precipitate.	100
Borax.	18
Soda.	10
Silica.	5
Nitre.	2

Melting is done in oil burning tilting furnace using a No. 275 long lipped crucible. The time taken for melting a month's run of precipitate approximates 20 hours. One graphite pot lasts two melts. About 25 pounds of matte is recovered, each melt having a value of about \$25 per pound.

The matte is reduced with cyanide and borax in the usual proportions, the slag from which assays about \$2.50 per pound. The bullion recovered is 680 fine in gold and 210 fine in silver, having a total value per ounce of \$14.

TRIUMPH MINES, LTD.

South Poreupine, April 22.—Very satisfactory results are being realized from the development work now in progress on the Poreupine Success property, owned by the Triumph Mines, Ltd. The shaft is down to the 200-foot level and crosscutting is being pushed. This shaft will be continued to the 300-foot level, and it is the intention to go ahead immediately with the sinking of a double compartment shaft on another part of the property, as recommended by Mr. Peter McLaren, who is on the property overseeing operations.—Poreupine Herald.

CANADIAN MINING INSTITUTE, WESTERN BRANCH

The twenty-first general meeting of the Western Branch of the Canadian Mining Institute was held at Ladysmith, Vancouver Island, B.C., on Thursday, March 30th, presided over by Mr. Thos. Graham, of Victoria, chief inspector of mines for British Columbia, who is this year's chairman of the branch.

Afternoon Session.

At the afternoon session a welcome was extended by the Mayor of Ladysmith, who also expressed the hope that it will not be long before the branch will again meet in Ladysmith. The chairman briefly acknowledged the courtesy of the mayor and other prominent citizens, and then gave a general review of the progress and condition of the mining industry of British Columbia.

A paper by Mr. W. J. Dek, of Ottawa, mining engineer to the Canada Commission of Conservation, presented at the annual meeting of the Institute, held in Ottawa early in March, was read by the secretary of the branch, Mr. E. Jacobs, of Victoria, and discussion was invited thereon. Mr. J. H. Cunningham, manager of the Extension colliery of the Canadian Collieries (Dunsmuir), Ltd.; Mr. W. M. Brewer, of Victoria; the chairman, and others discussed the paper. In the course of the discussion mention was made of the efforts of the Ladysmith Board of Trade, and the boards of other cities, to induce the Dominion Parliament to impose a customs duty on fuel oil imported into Canada, and a vote of thanks was passed to all who assisted in promoting that movement, which had been successful. Mr. G. A. Bonnallie, president of the Ladysmith Board of Trade, spoke briefly in acknowledgment.

Expressions of opinion were invited relative to a proposal made last year by Mr. E. A. Collins, of Kingston, Ontario, that "without taking into account the Albert Medal given by His Majesty the King for bravery and leaving aside the medal and other recompense provided for by the Carnegie Hero Fund, the Canadian Mining Institute provide a suitable medal to be granted in recognition of bravery by workmen in our mines and smelters." The secretary read the letters of Mr. Collins and other members of the Institute that had been published in the C. M. I. Monthly Bulletin, among them one in which Mr. Thos. Graham, chief inspector of mines for British Columbia, had stated his view that "the Albert Medal has a value far in excess of any reward that could be offered by the Canadian Mining Institute. The thing most needed to obtain recognition for our heroes of mine and smelter is the help of some recognized institution to assist in arranging the facts, presenting, endorsing and pressing the claim for recognition for the Albert Medal upon the proper authorities, which important part of the work could be taken up by the Canadian Mining Institute." After an interesting discussion, on the motion of Mr. H. N. Freeman, manager for the Vancouver-Nanaimo Coal Mining Co., seconded by Mr. J. H. Cunningham, Mr. Graham's view of the question was endorsed by the meeting. The session was then adjourned to allow those present to visit the Extension colliery, ten or twelve miles away, going by train, to see the mine-rescue training station and the ambulance car of the Canadian Collieries Co., both in immediate proximity to the main entrance to the largest of the Extension mines. On return to Ladysmith, Mr. Cunningham took the visitors to see the coal-washery and coal-bunkering

facilities at the company's coal shipping docks on Oyster bay, within half a mile of the business centre of Ladysmith.

Evening Session.

At the evening session, which was attended by more than 100 residents, chiefly coal miners, Mr. Brewer, continuing the discussion of Mr. Dick's paper on "The Coal Situation," gave some instructive information concerning by-product coke ovens, the installation of which at well-chosen points was advocated by Mr. Dick.

Mr. Cunningham gave interesting particulars of work done in making a 300-foot vertical raise in No. 3 mine, Extension colliery, and in this connection Mr. Graham added information relative to his own experience in doing similar work elsewhere.

Mr. James Strang, Mr. Cunningham's assistant at Extension colliery, read a paper on First-Aid and Mine-Rescue Work in Ladysmith District, and gave particulars of the number who had been instructed in rendering first-aid to the injured and the excellent results that had been achieved. Mr. Dudley Michell, instructor in first-aid for the British Columbia Department of Mines, supplied data concerning the considerable activities at both coal and metal mines in the province in connection with instruction and competitions in both first-aid and mine rescue work. Mr. Graham added particulars of the oxygen-breathing and other mine-rescue apparatus at coal and metal mines. Numerous lantern slides were shown, giving views of competitions, competing teams, rescue stations, ambulance cars, etc., in British Columbia. Mr. Graham made an announcement of especial interest to miners, in effect that mine-rescue training certificates issued in British Columbia would be recognized in the United States by the United States Bureau of Mines under stated proper conditions, and, similarly, those obtained in that country would be recognized in British Columbia.

Some information regarding analyses of mine air, made at Ottawa, and the unusually large quantities of gas given off in certain mines, submitted to the meeting by the chairman, caused much surprise.

A number of lantern-slide views in connection with the hydro-electric power system on Puntledge river, Comox district, Vancouver island, which supplies electric power to several of the mines of the Canadian Collieries Co.'s Comox colliery, were shown, with some explanatory comment. Then followed views of modern bankheads and other surface works at several Vancouver Island coal mines; a few views of Nicola Valley coal mines, and the big near-surface deposit of coal at Corbin, Crow's Nest district.

The session was closed with votes of thanks to those who had contributed papers, to the district press, and to residents for many courtesies shown.

HUDSON BAY ZINC CO.

Nelson, B.C.—In the last issue of the British Columbia Gazette is announced the incorporation of the Hudson Bay Zinc Co., Limited, with a capitalization of \$5,000,000, divided into 1,000,000 shares.

The company is empowered to carry on a mining and smelting business and to purchase from Maurice W. Bacon and William E. Cullen, Jr., fourteen mining claims situated in the Kootenay mining division. The Hudson Bay Co. has its headquarters at Salmo. Maurice W. Bacon and William E. Cullen, Jr., are at present associated with others in the operation of the Hudson Bay mine at Salmo, which it is believed will be the principal property to be controlled by the new company.

PERSONAL AND GENERAL

Mr. Robt. Bryce has returned to Toronto after visiting a property at Porcupine with Mr. G. C. Bateman.

Mr. John Macdonald has been appointed mine captain at the Deloro property now being developed by the Coniagas company.

Mr. Geo. G. Thomas has been appointed manager at the Dome Lake mine, Porcupine.

Mr. W. D. Keeley, mine superintendent at the Dome Lake mine, has resigned.

Col. A. M. Hay was at Timmins last week after visiting the Lucky Cross mine at Swastika.

Mr. H. W. Hardinge was at Porcupine last week. He has returned to New York.

Mr. P. Negriz has returned to New York from Boston Creek.

Mr. M. Summerhayes, manager of the Porcupine Crown mine, has returned to Porcupine.

Mr. D. A. Dunlap is in California.

Mr. M. J. O'Brien has been elected a trustee of Queen's University, Kingston.

Mr. W. H. Robinson, new president of Canadian Consolidated Rubber Co., is vice-president of Granby Mining, Smelting & Power Co. and a director of Crowsnest Pass Coal Co.

Mr. E. C. Kingswell is at Haileybury.

Mr. H. S. Robinson is in charge of operations at the Lucky Cross mine, Swastika, and at the Rochester mine, Cobalt, for the Trethewey Mining Co.

Mr. Clifford Smith is at Timmins, Ont.

Mr. G. C. Bateman has returned to Toronto from Porcupine.

Mr. Charles Spearman has been appointed manager of Adanae Silver Mines, Ltd., operating a property near the Temiskaming mine.

Mr. R. B. Lamb has moved his office to 25 Broad St., New York, from 43 Exchange Place. Mr. Lamb is now consulting engineer for Oatman Southern Mining and Milling Co. and Pittsburgh Mining and Milling Co., also of Oatman.

Mr. P. A. Robbins was in Toronto last week.

Mr. C. A. Foster is in Toronto.

Mr. Harry Oakes was in Toronto last week.

Mr. C. H. Hitchcock, of Copper Cliff, was in Toronto last week.

Mining and Scientific Press, San Francisco, says: "Frank A. Ross, of Spokane, Washington, was honored at the recent inauguration of Dr. Ernest O. Holland as President of the State College of Washington, Pullman, by having conferred on him the degree of Master of Science in Engineering 'in recognition of his service to the mining industry of the Great West.'" Mr. Ross was for some time general manager for the estate of the late Marcus Daly, of the Nickel Plate group of gold mines and the 40-stamp mill and cyanide plant, in Camp Hedley, Similkameen, B.C.

Mr. H. Foster Bain, of London, England, editor of The Mining Magazine, has gone to Johannesburg, South Africa, to study mining conditions on the Rand.

Mr. W. B. Bishop, superintendent of the Granby Consolidated Co.'s copper smelter at Grand Forks, Boundary district of British Columbia, has been spending two or three weeks in the Coast cities of the province.

Mr. R. Randolph Bruce has returned to East Kootenay, British Columbia, after having been in England for the winter.

Mr. Wm. Thomlinson, of New Denver, B.C., who did such good work in collecting British Columbia minerals for inclusion in the Canadian exhibit at the Panama-

Pacific International Exposition, and afterward in giving to thousands of visitors to the Canadian pavilion much useful information relative to the mineral resources and mining industry of Canada, has been appointed to the Canada Exhibition Commission staff at the Panama-California Exposition at San Diego, California, whence he went about the middle of April. Canada's very fine exhibit at San Francisco has been removed to San Diego, where it will remain until the close of the exposition there next year.

Mr. Anthony J. McMillan, of London, liquidator of the Le Roi Mining Co., is expected to shortly visit Northport, Washington, where is situated the company's smelting works, sold last year to prominent mining men and capitalists of the Coeur d'Alene district of Idaho, U.S.A.

Mr. R. P. Williams, of Vancouver, B.C., well known to mining men in British Columbia as the representative of the Ingersoll-Rand machinery manufacturing company, went to New York City last month.

Mr. J. W. Bryant, for several years mine superintendent for the Tyee Copper Co., operating in British Columbia, and afterward in Asiatic Russia in charge of a mine for a British company, expects to shortly go from England to the Continent on active military service.

IN THE PAS DISTRICT.

The Pas Herald, published at The Pas, Manitoba, published on April 21 the following notes on activities in Manitoba's new mining camp:

Mr. Jack Hayes is opening a stopping place at the mouth of the Goose river, where the Ross boats will land this summer, en route to Flin-Flon, Schist Lake and the sulphide fields.

Jack Callinan is looking after the five claims he sold for Zar Crittenden and E. R. Cullity, at Flin-Flon. Callinan says the deal went through, the papers are signed, and the money paid.

Mr. B. M. Stitt has given a 30-day option on his three claims at Flin-Flon to M. B. Gordon, for \$50,000. The claims adjoin the Crittenden group. Mr. Gordon is a former manager of the Cobalt Lake Mining Company. He also has the option on the Rex claims at Herb Lake.

Mr. Jack Hammell is in Toronto and is expected in The Pas early next month.

The winter rush to Little Herb Lake resulted in strong reports of the gold showings there, but it now develops that the showings are confined in less than an inch stringers, though free gold runs through plentifully. Prospecting done there has been practically of no account. The overburden is heavy and the underbrush quite thick, which has militated against intelligent work, and the few men who have been in there have done very little to determine the status of the mineral deposit.

The diamond drill operations at Flin-Flon appear to be satisfactory. The drillers and engineers are loath to say what the results amount to, and any reliable information is difficult to secure. The Herald depends upon its source of information from trappers, dog mushers and teamsters, who worm it out of the drillers and engineers in an innocent, unsophisticated manner, and everybody is made happy about it.

Mr. M. H. Newman, geologist of the Great West sulphide mines at Flin-Flon, got in from Mascot, Tennessee, yesterday, en route to the mines.

Mr. C. B. Flynn, the well known Ontario mining capitalist, is expected here with Jack Hammell next month, to inspect Flin-Flon.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE, SWASTIKA

Porcupine Vipond.—The development of most interest in the camp during the past two weeks has been the striking of the Davidson vein on the Porcupine Vipond. Owing to the active market in the stock, details on the Vipond are usually watched with a very great deal of interest. The last report issued covering the last three months of the year 1915, revealed such a discouraging production that the better development of the 400-foot level was the more welcome. There has now been opened up from the winze at the 400-foot level an ore shoot 135 feet long averaging between 5 and 6 feet wide and about \$15 ore. This is, of course, about double the value of mill run during the latter part of the year 1915. From the winze little or no ore was encountered for 180 feet. A crosscut was then started and only a few feet to the north the vein was picked up. It was driven on towards the shaft. About 30 feet from the shaft the vein again broke up into small stringers and it was decided to crosscut directly in the shaft with the purpose of raising and making connections with the 300-foot level. The exploratory crosscut was commenced about 180 feet from the winze, but the vein was not picked up until it was about 12 feet further to the north than on the 400-foot level. It was then encountered. The vein is about 10 feet wide, of \$10 ore and it shows every evidence of developing into a fine ore-shoot. This discovery consolidates the ore reserves of the Vipond and makes the prospects of the company very much better. But those who would look for an immediate increase in the production will probably be disappointed. The mill will run on the lower grade of ore on the upper levels until direct connection has been made with the winze and the 400-foot level, and the cage is running down to the 400-foot level. This aim may not be attained until the beginning of June.

The Hollinger Merger.—There is no official pronouncement yet as to the probability of the merger of the three properties contained within the control of the Canadian Mining & Finance Co. It is generally believed that there is much more probability of it than at any previous time. Four years ago the amalgamation of the Hollinger Gold Mines, Acme Gold Mines and Millerton Gold Mines was mooted and was very nearly put through. It was then contended, however, that the Acme was an undeveloped prospect and could not be valued with any definiteness. To-day it is a mine and second only to the Hollinger in the Pearl Lake area and consequently the valuation of it can be much better established. The desirability of the merger from the operating standpoint is so obvious as to need no further explanation. The central shaft will be the basis of all operations and if the identity of the three companies within the Canadian Mining and Finance is maintained, it will avoid much needless duplication of staff and bookkeeping.

Dome Mines.—The delivery of mining machinery is to-day the greatest barrier to the quick construction of plant in the Porcupine camp. This applies very particularly to the Dome, where so much machinery is at present on order. It is probable that hoisting from the big central shaft may be delayed by the non-arrival of the two big winding engines, delivery of which cannot be ascertained definitely. In the meantime the 125-foot steel head frame will be set up at once. The shaft itself is now completed to the 700-foot level and until such time as it is possible for hoisting to be undertaken

from the new shaft it is not probable that it will be sunk further. It is from this shaft that the development of the Dome Extension will be undertaken by the Dome.

McIntyre-Jupiter.—The slow delivery of machinery has also been responsible largely for the delay in making the Jupiter productive. It was hoped that the two vertical compressors from Scotland would be installed for the Jupiter, so that hoisting could be commenced with the enlarged plant, but there have been so many delays in shipping that the old compressor will be used for starting operations. It is reassuring to know, however, that the two compressors have arrived in Canada and should soon be at the mine. The rock-house and head frame at the Jupiter have almost been completed and the surface tramway from the No. 5 shaft to the Jupiter is well under way. The ore will be taken from the Jupiter shaft over the surface to the No. 5 shaft and there sent over the aerial tramway to the McIntyre mill. This is only a temporary arrangement until the long crosscut between the old shaft of the Jupiter and McIntyre Extension shaft is completed. This will be a long undertaking, however, and in the meantime the ore will be trammed over the surface. The various units of the McIntyre mill are not yet running and capacity of the maximum of 450 tons a day may not be attained until Jupiter ore is available. The last quarterly report of the McIntyre was a great improvement on the previous one. Tonnage was 27,248; an increase of over a thousand tons. The value of ore treated was 35 cents a ton higher, while the operating costs were 31 cents a ton less giving an increased operating profit of \$21,643 for the quarter, or \$91,128. Operating costs were \$3.85 and gross value \$210,840, from which a recovery of 95.4 per cent. was made. At No. 5 shaft on the 700-foot level the crosscut to the north intersected a large ore-body which had been previously cut by diamond drilling. The width of the vein was 17 feet of high grade milling ore. In continuing this crosscut to the north a parallel vein was intersected at a distance of 12 feet beyond the first vein, showing high grade milling ore 4½ feet in width. The crosscut from the McIntyre Extension shaft to the No. 5 shaft at the 1,000-foot level is well advanced, and from 10 to 15 feet a day is being made.

La Rose and Coniagas in Deloro.—Owing to the advent of two companies with adequate reserves it is most probable that Deloro will be the centre of very active mining operations all this year. The La Rose is working the Maidens-MacDonald quite actively and it is announced that at least one of the diamond drill holes has been quite satisfactory. A shaft is also being sunk. The Coniagas Mines has now one diamond drill running and it will be put down to 800 feet and an adit will also be started on the same vein.

Standard.—The Porcupine Premier is running drills on the old Standard and the Chisholm Corporation has five diamond drills operating on the Chisholm veteran.

West Dome.—Mr. Trethewey has taken up his residence at the West Dome Consolidated and a diamond drill is already running. It will be put down to 800 feet so as to cut the vein if sunk on at the shaft. The shaft will be put down on its present incline of 65 degrees to the 300-foot level, but not until then will exploration be commenced. Exploration at this property was previously of a very haphazard nature and few records were left to guide the new management. There are no less than seven shallow shafts on the property.

Dome Lake.—Owing to an imminent change in the control of the Hudson Bay Mines, Mr. A. H. Brown has resigned his position at the Dome Lake. He has been in charge here since the Hudson Bay bought control of this property. Mr. Keely, mine superintendent, has also given in his resignation which will take effect on the first of the month. The agitation drum which is to treat the tails from the plates is now installed and should be running very shortly. There is much speculation as to whether the process can be made a success. It is quite new in camp and the innovation is being watched with much interest.

Copper.—Owing to the very keen demand for copper, various syndicates are busy looking up what deposits there are in the north country. The Rand Syndicate has already shipped two cars of copper from Temagami; one from Cedar Lake, and one from a point two or three miles west of the settlement. On the T. C. R. Mr. Campbell and a Montreal syndicate are taking copper out of a deposit near Spirit Lake about 190 miles east of Cochrane. The same company is also mining molybdenite south of the track at Keewagama. A New York and English syndicate represented here by Mr. W. E. Simpson is also preparing to develop molybdenite prospects at the same point. Mr. Simpson has had great success with oil flotation as a method of concentration with this ore and his company will go forward with the project very shortly.

Lake Shore.—At Kirkland Lake the most interesting note of the last two or three weeks is the striking of what may be a new orebody on the Lake Shore. In a crosscut on the 300-foot level to the north of the main drift a vein has been picked up about seven feet wide. There is about six inches of remarkable high grade ore and the milling average will be quite high.

The question of power is the most debatable matter in the camp at present. For various reasons the Northern Ontario Light and Power has hesitated to extend its transmission lines to Kirkland Lake. The tremendous price of copper is one of the factors in the situation. It is believed, however, that the company will put through lines this year.

Teck-Hughes.—The Teck-Hughes mill is finished and mining commenced again on April 17th. The sampling of the first level of the Lucky Cross has been completed and drills are now running, it is stated, and results to date are quite reassuring.

COBALT, GOWGANDA AND SOUTH LORRAIN

The high price of silver is having a tendency to open up old prospects. This seems to apply to out-lying sections more than to Cobalt proper.

In Gowganda, it is reported that the Bishop Silver Mines have struck some high grade 800-foot back in the tunnel they are running. This is one of the properties operating near Calcite lake, in the Wigwam district at Gowganda; the other is the Barbara Mining Co. In Gowganda itself the leasing company operating the Reeves Dobie, is assembling a rich car of ore.

At Elk Lake there has been much activity in Auld township where the Kenabeek mines and several other prospects are developing. There are here some very rich, but very narrow, silver veins in the diabase.

In South Lorrain, the success of the Comfort Mining & Leasing Co. in opening up the Wettlaufer will stimulate interest. The leasing company has already sacked several bags of high grade ore and is putting the old

mill in shape to treat the lower grade. It is expected that a shipment will be made soon after transportation opens on the lake. The Belle Ellen is also working with encouraging results.

The winze being sunk below the 200-foot level on the McKinley-Darragh is producing quite interesting results. This winze is being put down in the footwall of the Cobalt Lake fault. It is now down 150 feet and is still in good conglomerate. While there is nothing definitely established this fact gives promise of a much deeper area than could have been anticipated a year ago.

BRITISH COLUMBIA

An amendment to the law relating to disposal of Crown-granted mineral claims that have been forfeited to the Crown for non-payment of taxes on such property, is proposed by the Government of British Columbia. This provides that such claims may be leased from year to year, that the lessee may go on and work them, and at any time during the pendency of his lease may himself obtain a Crown-grant on paying all taxes, costs and charges on the claim, provided he shall have expended in doing development work on the property not less than \$200 annually during his lease, in which event no taxes shall be levied on the claim for the term of the lease.

Cariboo.

This district did not share in the unusually heavy snowfall which in February was experienced in the lower Coast district, and some other parts of British Columbia, consequently the outlook for there being an abundant supply of water for hydraulicking purposes at the Cariboo placer-gold mines was not so good as had been hoped it would be. However, it appears that conditions in this respect are improving, for a weather report published in Victoria on April 13th included the following information: "The region of the Cariboo was the coldest area on the weather map and the scene of continual snowfall. For the week ended April 11th, sixteen inches of snow has fallen at Barkerville. It was still snowing there when this report was made to the local meteorological station last night."

Kamloops District.

The **Iron Mask** mine, situated about six miles southwest of the town of Kamloops, for several years has been the only metalliferous mine in Kamloops district to ship ore to a smelter. Its output of ore and concentrate during 1915, shipped to Trail, was approximately 2,000 tons; during the first quarter of 1916 receipts at Trail from this mine totalled 738 tons. Quite lately, the **Foghorn**, in the northern part of Kamloops mining division sent out some ore, while several carloads have been shipped to Boundary district smelting works from the **Aberdeen**, in Nicola mining division, formerly part of Kamloops district.

Foghorn.—It is of interest to note that the shipment of 52 tons of ore from the Foghorn which reached Trail early in April was the first received from that property and probably the first ore ever shipped in bulk from it. Mr. W. M. Brewer, who in 1913 investigated mining conditions in Kamloops mining division for the Provincial Department of Mines, in his report gave a little information concerning this property, as follows: "The Foghorn group of mineral claims is situated on Whistler mountain, about 20 miles northeast of Chu Chua, at an elevation of about 4,000 feet above the North Thompson valley.

able to take over the company and its assets. In the meantime, all of the stock of the company is being held in escrow, but as our development progresses, it is arranged that we will receive stock from month to month for our expenditures. At the end of the year, if the development proves satisfactory, we can then exercise our option by taking up the balance of the stock at prices which we deem to be very attractive."

SUDBURY'S PRODUCTION.

The Sudbury nickel-copper district has produced nickel-copper matte containing 237,202 tons of nickel and 146,661 tons of copper, besides considerable though comparatively small amounts of platinum, palladium, gold and silver. The value of the nickel-copper matte produced is about \$150,000,000.



The recently constructed Teck-Hughes mill, Kirkland Lake.

The main shaft is now down 200 feet and we are cutting the station at the 175-foot level. We have been sinking on a vein of high-grade ore most of the way down and there is every reason to believe that only lateral development is necessary to put ore in sight. We have two other veins on the property, but no work has been done on them.

TONOPAH DRILLING AT SCHIST LAKE.

The Pas, April 22.—The diamond drill on the Tonopah properties at Schist Lake, near Flin-Flon, was spaded early in the week, and drilling commenced, is the report from the north. The scene of the first drilling is near the lake shore on the Mandy claim. The vein width on this property is said to be fifty feet wide, all in ore, with ten feet of rich copper. It is understood the drilling is for depth values to begin with.

AT FLIN-FLON LAKE.

Reports from the diamond drilling at Flin-Flon say the drills are working at their third set of holes. No detailed information was given out. The results continue to please the engineers and drillers, it is said, and they are waiting for some returns of the assayers on the values in the diamond drill cores sent them. From a reliable quarter it is learned that the average value of the sulphide hovers between \$10 and \$12 a ton.—The Pas Herald.

COBALT SHIPMENTS.

Cobalt, April 22.—Ore shipments for the week ending last night showed a considerable increase over the period immediately preceding. Five companies shipped a total of 669,717 lbs., compared with 471,877 lbs. the week preceding. The Dominion Reduction led with three cars totalling 238,000 lbs. Of the nine cars shipped, only one went to a Canadian smelter; one car from Seneca-Superior going to Thorold, Ont. The bullion shipments were lower than last week. A total of 91,423.88 oz. was shipped, compared with 375,295.24 oz. the previous week.

Ore shipments for the week were as follows:

Company.	Lbs.
McKinley-Darragh.	171,920
Dominion Reduction.	239,000
Peterson Lake (Seneca ore).	93,892
LaRose mines	87,830
Beaver mine	77,075

Bullion shipments for the week were:

Mining Corporation.	32	41,323	\$26,980
Nipissing.	43	50,099	33,340

Bullion shipments for the year to date are as follows:

Company.	Oz.	Value.
Nipissing.	1,941,623	\$1,394,695
Mining Corporation.	176,043	111,262
Dominion Reduction.	132,860	78,137
Crown Reserve	95,495	57,300
O'Brien mine	91,549	56,604
Miscellaneous.	14,703	8,388



Looking north from Dome mine, showing location, left of photo, of hoist house for new shaft.

HOLLINGER MERGER ANNOUNCED

Just as we go to press on April 29, we have received word that the expected merger of Hollinger, Acme and Millerton properties has finally been decided upon. Claim 13,147 is included.

The properties are to be amalgamated with a nominal capital of \$25,000,000, of which \$24,000,000, in 5 shares, will be issued, \$1,000,000 in shares remaining in the Treasury of Hollinger Consolidated Mines, Limited, which will be the title of the new corporation.

The allocation of the capital of Hollinger Consolidated will be as follows:

	Shares.	Par Value.
In treasury	200,000	\$1,000,000
Issued to Hollinger shareholders	2,400,000	12,000,000
Issued to Acme shareholders ..	2,100,000	10,500,000
Issued to Millerton shareholders	200,000	1,000,000
Issued to Canadian Mining & Finance Co., Limited	100,000	500,000
	5,000,000	\$25,000,000

The most interesting feature of the exhaustive and detailed report submitted by General Manager Robbins deals with the allowances for ore at depths below those already reached by development upon the two principal mines. On the basis of a depth of 800 feet it is estimated that the Hollinger and Acme will have 5,594,370 tons of ore of a gross value of \$48,196,390. On the assumption that the veins persist to a depth of 1,400 feet it is estimated that the two principal properties concerned will account for 10,430,000 tons, with a value of \$81,492,000.

According to the arrangement, Hollinger holders will receive four shares of stock in the consolidated company in exchange for each share of their present holdings, the same rate of dividend as they are now getting, and besides having "increased flexibility in a stock having a smaller market value" they have the assurance of General Manager Robbins of the Hollinger to this effect:

"It is my opinion that Hollinger Gold Mines, Limited, with its assets in cash, bullion, plant, development and indicated ore, is approximately of the same value as the total collective value of Acme Gold Mines, Limited, Millerton Gold Mines, Limited, and Claim 13,147, with their respective plants, developments and indicated ore, and, in addition thereto, the specified plant of the Canadian Mining & Finance Co., Limited, and as a result of this opinion, I recommend that the interests of Hollinger Gold Mines, Limited, and Canadian Mining & Finance Co., Limited, as described herein, be consolidated upon the basis of an equal valuation being ascribed to each of the two interests, the valuation being taken as at January 1, 1916. By so consolidating their holdings the parties thereto will receive the following benefits:—(1) Freedom from loss in case of any geological disturbances found to affect the orebodies. (2) A speculative chance spread over a large area. (3) Lowered working costs.

These conclusions are premised upon analysis of the mining position at the respective properties, their liquid assets and plants and speculative factors, briefly summarized in this way: First—Estimated future profits based upon known ore reserves. Second—

Speculative chances for development beyond present ore reserves. Third—Expenditures already made in plant and development, and live assets, such as cash, investments, etc.

Having established the facts warranting the consolidation, Hollinger ore reserves counterbalancing those of the other properties, the General Manager reinforces his contentions with this optimistic forecast of the future:

The extension to Hollinger mill should be completed by the middle of May, and after that time we shall be able to treat 1,900 tons daily.

At the present time we are treating for Hollinger and Acme 1,500 tons daily, from which the combined net profits are approximately \$220,000 per four weeks. The increased tonnage should therefore increase the profits to \$280,000 per four weeks.

Present Hollinger dividends demand \$120,000 per four weeks, and to maintain this same disbursement to present Hollinger shareholders after consolidating the companies will demand a total of \$240,000 per four weeks.

During the year the central shaft plant must be completed and the Hollinger mill extended to a capacity of 3,500 tons daily. This work will require about one year for its completion and will entail the expenditure of \$750,000 on capital account.

The cash at present in Hollinger treasury will provide \$300,000 of this amount, leaving \$450,000 to be furnished from operations, this being at the average rate of \$34,600 per four weeks. Therefore, our probable income and expenditures per four weeks should be:—

Profits from operations	\$290,000
Disbursements ..	240,000
Required for plant	34,000
Available for development, taxes and sundries ..	15,400
	\$290,000

With the completion of a mill of 3,000 tons daily capacity, we shall probably be able to increase our rate of dividend, and at the same time reduce the value of the ore being treated.

For five years the problem of bringing these properties together has always been in mind. The results of geological research, the solving of milling details, the centralizing of plant of a permanent nature, and the gradual development of underground workings have all been shaped with the idea of ultimately consolidating the properties; and to-day that consolidation is possible. We have reached a point where comparative valuations of the properties may be made, and where the interests of all may be greatly benefited by an amalgamation.

To this may be added the surplus and investments in plants, making in all a gross value of about \$36,000,000 for the purposes of the merger. However, as Mr. Robbins points out, this estimate, as applied to the reserves and immediate mining outlook, is "figured within narrow limits and makes no allowance for the probabilities of ore persisting more than fifty feet beyond the underground working faces." Anyhow, taking the foregoing estimate and assuming "working costs will probably be close to \$3.15 per ton and metallurgical losses not greater than 45c per ton, which makes an allowance of \$3.60 per ton to cover the costs of mining and mill-

ing," upon this basis Hollinger is expected to "show a profit of \$6.05 per ton, while Acme will show a profit of \$5.38 per ton." In that event the gross profits on the tonnage and values as given would be: "Hollinger, \$11,168,300; Acme, \$10,094,816.80, or \$21,263,116.80, as against the issued capital of Hollinger Consolidated, the surplus and the plants, exclusive of the Millerton and Claim 13,147, as they stand. But as \$1,250,000 profit is to be credited to the Millerton and a nominal \$200,000 to Claim 13,147, the mining position at the moment may be taken to represent an assured profit of about \$23,500,000, as against the issued capital of \$24,000,000, leaving all other potential considerations throughout the properties to be fully demonstrated. What those considerations are likely to be is discussed by Mr. Robbins. "Assuming that each vein," of which he has positive information, or a certain amount of proof, "will persist throughout its length to the depth of the deepest working on that vein," he offers this as an estimate:

	Tons.	Value per ton.	Gross value.
Hollinger	2,076,300	\$9.44	\$19,593,600
Acme	2,315,990	8.85	20,507,750
	4,392,290		\$40,101,350
Indicated profit on the above:			
Hollinger			\$12,125,592
Acme			12,158,947
			\$24,284,539

This "allows for no ore at depths below those already reached by development upon the various veins. A limited amount of development work upon the Hollinger and the Acme at the 800-foot level has proved that several of the veins persist to that depth, and, although it may be that some veins do not do so, yet it is quite possible that as work at this level advances it will be found that all of the veins do so persist. At any rate, each property has an equal chance in this respect." Again, taking it for granted, as an hypothesis, "that each orebody now being developed will persist to a depth of 800 feet, and if we apply to each orebody the values and widths shown upon the lowest present working upon that vein," Mr. Robbins ventures this further estimate:

	Tons.	Value per ton.	Gross value.
Hollinger	2,571,900	\$8.93	\$22,983,000
Acme	3,022,670	8.34	25,213,390
Totals	5,594,570	\$17.27	\$48,196,390

There is \$14 ore on the 1,250-foot level of the Hollinger No. 1 vein just now. Late advices state that there is 23 feet of ore worth over \$50 per ton in one of the Acme orebodies at the 800-foot level. Therefore continuity of the veins and values are being proved and warrant optimism. Mr. Robbins emphasizes that the five and a half million ton estimate in certain eventualities allows for "no ore below depths already reached." He restrains himself while tantalizingly dangling dainty morsels like the following:

In the fourth annual report of Hollinger Gold Mines the results of diamond drilling to a vertical depth of 1,485 feet were given. It was shown that at least some veins with their gold contents persisted to a depth of 1,450 feet. In a wince upon the Hollinger we have recently located \$14 ore at a depth of 1,250 feet. If as a

means of further investigating the comparative possibilities of Hollinger and Acme we assume that all the orebodies being developed will persist to a depth of 1,400 feet, and if we ascribe to them conservative values proportionate to the values of the different veins at their upper levels, then this may ensue:

	Tons.	Value per ton.	Gross value.
Hollinger	4,133,200	\$7.68	\$31,737,700
Acme	4,655,070	7.24	34,322,390
Totals	8,788,270	\$14.92	\$66,060,090
Indicated profit on this may be:			
Hollinger			\$16,863,456
Acme			16,944,454
Total			\$33,807,910

Again Mr. Robbins writes with reserve on those figures—one of a "series of assumptions"—but he also directs attention to the fact that even these globular amounts are irrespective "of the persistence of the miscellaneous surface outcrops to a depth greater than 100 feet below the surface. If we assume," he adds, "that those outcrops or their equivalents do persist to a depth of 1,400 feet, and if we ascribe to each vein 80 per cent. of the tonnage so indicated and an average value equal to 60 per cent. of the values obtained at the surface, we have the following as a possible grand total:

	Tons.	Value per ton.	Gross value.
Hollinger	4,520,800	\$7.82	\$35,385,700
Acme	5,909,230	7.80	46,106,890
Totals	10,430,030	\$15.62	\$81,492,590

"Manifestly these two properties, exclusive of the Millerton and Claim 13,147, have attractive certainties and seductive possibilities. For 2,945 feet of Acme outcrops only a nominal credit of 133,840 tons containing \$1,592,500 is taken into account. Hollinger has a similar outcropping situation. Both afford a unique basis for the merger, and promise infinitely more than can be assumed."

TRETHEWEY AND HUDSON BAY.

Operations at the Trethewey and Hudson Bay silver mines at Cobalt, which have been closed down for some time, are to be resumed shortly.

CHAMBERS-FERLAND.

Cobalt, April 28.—Development of the new vein at the Chambers-Ferland is most promising. At the middle of the week it has been driven on for nineteen feet. For that distance the vein averaged from three to five inches of high grade ore with fair values in the wall rock.—Northern Miner.

THE CROESUS.

The results obtained at the Croesus mine are briefly stated by Mr. T. F. Sutherland in a recent article. He says: "In Munro township a group of claims which had been located, but idle for three years, was optioned by a Cobalt company. A prospect shaft 6 x 11 ft. was sunk on the vein, and from this shaft, above the 100-ft. level, \$120,000 in gold was taken out in sinking operations, and in six months about \$1,000,000 worth of ore was blocked out with a small prospecting outfit."

MARKETS

NEW YORK MARKETS.

April 20, 1916—Connellsville Coke—

Furnace, spot, \$2.25 to \$2.50.

Contract, \$2.50 to \$3.00.

Foundry, prompt, \$3.75.

Contract, \$3.50 to \$4.00.

April 20, 1916—Straits Tin, nominal, 50.00 cents.

Copper—

Prime Lake, nominal, 29.50 to 30.00 cents.

Electrolytic, nominal, 30.00 to 31.00 cents.

Casting, nominal, 27.50 to 28.00 cents.

Lead, Trust price, 7.50 cents.

Lead, outside, nominal, 7.50 to 7.62½ cents.

Spelter, prompt western shipment, nominal, 18.67½ to 19.17½ cents.

Antimony—

English brands, nominal.

Chinese and Japanese, 39.50 to 40.50 cents.

American, 39.50 to 40.50 cents.

Aluminum—nominal.

No. 1 Virgin, 98-99 per cent., 59.00 to 61.00 cents.

Pure 98-99 per cent. remelt, 57.00 to 59.00 cents.

No. 12 alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$125.00.

Platinum—Nominal, \$88.00.

Cobalt (metallic), \$1.25.

Silver (official), 65½ cents.

Metal Products.—All prices are nominal as follows:—

Sheet copper, base, 35.50 cents.

Copper wire, base 32.50 to 33.50 cents.

High sheet brass, base, 38.00 cents.

Seamless brass tubing, 43.50 to 44.50 cents.

Seamless copper tubing, 43.50 cents.

Brazen brass tubing, 42.50 to 43.50 cents.

Brass wire, 38.00 cents.

Brass rods, 38.00 cents.

Sheet zinc, f.o.b. smelter, 25.00 cents.

TORONTO MARKETS.

April 26—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 9½ cents per lb.

Tin, 54 cents per lb.

Antimony, 45 cents per lb.

Copper casting, 30 cents per lb.

Electrolytic, 31½ cents per lb.

Ingot brass, yellow, 16 cents; red, 21 cents per lb.

April 26—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

NEW YORK STOCKS.

April 25th, 1916.

	High.	Low.	Close.
Beth. Steel	439	429¾	439
Chino	53¾	53	53
Crucible	83¾	78¾	81¾
Dome	25	24¾	24¾
General Electric	162½	161½	162
Goodrich	76¾	76½	75¾
Gt. Nor. Ore	40	39¾	40
Int. Nickel	48¼	47¾	47¾
Kennecott	55¾	54¾	55½
U. S. Steel	84	83¾	83¾
do., preferred	116½	116¼	116½
do., bonds	104¾	104½	104¾

STANDARD MINING EXCHANGE.

Toronto, April 25th, 1916.

	Cobalt Stocks.	Ask.	Bid.
Bailey.	.08	.07¾	
Beaver	.41	.40¼	
Buffalo.	1.20	1.05	
Chambers-Ferland	.26¾	.26½	
Coniagas	4.70	4.45	
Crown Reserve	.56	.53	
Foster	.10	.09	
Gifford	.07½	.07	
Gould	.00½	.00¼	
Great North	.05½	.03½	
Hargraves	.05	.04¾	
Hudson Bay	...	26.00	
Kerr Lake	4.62½	4.37½	
La Rose	.63	.60	
McKinley-Darragh S.	.59½	.57½	
Nipissing.	7.37½	7.00	
Peterson Lake	.27½	.27	
Right of Way	.05	.04½	
Rochester	...	.03	
Shamrock	.18	.15	
Silver Leaf	.02½	.02	
Seneca	.48½	.47	
Timiskaming	.66½	.66	
Trethewey	.19	.18	
Wetlaufer	.09	.08	
York, Ont.	.02	.01	
	Porcupine Stocks.	Ask.	Bid.
Apex	.06¼	.05¾	
Dome Extension	.37	.36¾	
Dome Lake	.25	.24	
Dome Mines	25.37½	25.10	
Dome Consolidated	.15	.12	
Foley	.60	.50	
Gold Reef	.02½	.01¼	
Holly	29.75	29.00	
Homestake	.50	.47	
Imperial Reserve	.08¼	.07¾	
Jupiter	.21½	.20¾	
McIntyre	.93½	.92	
McIntyre Extension	.25	...	
Moneta	.12½	.10½	
Pearl Lake	.00¾	...	
Porcupine Crown	.70	.68	
Porcupine Imperial	.03½	.03¾	
Porcupine Tisdale	.017½	.01½	
Porcupine Vipond	.55	.54	
Preston	.04¼	.04	
Schumacher	.50	.40	
Teck-Hughes	.18½	...	
West Dome	.16½	.15	
West Dome C.	.24	.23	

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" 12.....	62¾	29 7/8
" 13.....	63	30
" 14.....	63¼	30 1/8
" 15.....	63¾	30 3/8
" 17.....	64	30 1/2
" 18.....	63¾	30 1/8
" 19.....	64½	30 3/4
" 20.....	65¾	31 1/8

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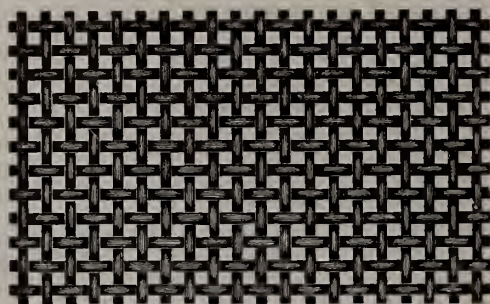
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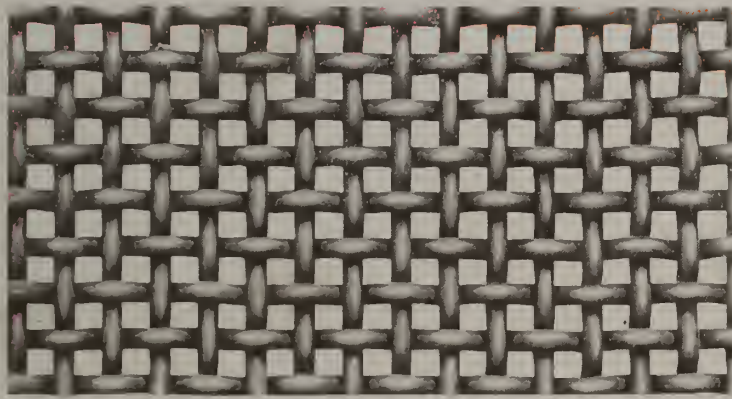
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VOL. XXXVII

TORONTO

No. 10



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- Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.
- Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.
- The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.
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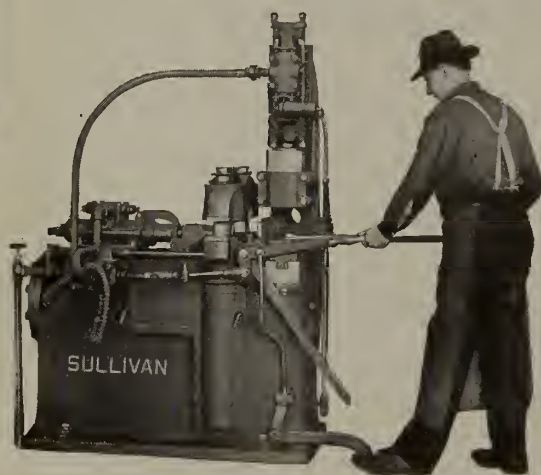
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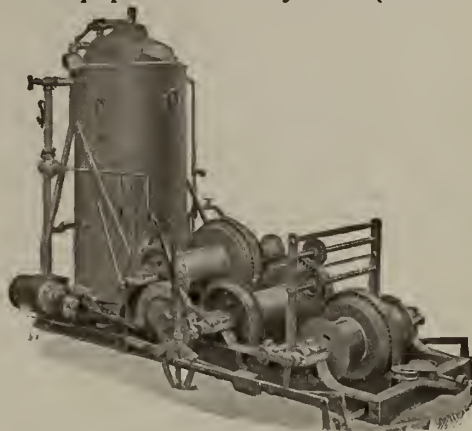
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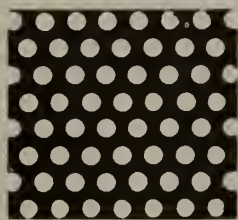
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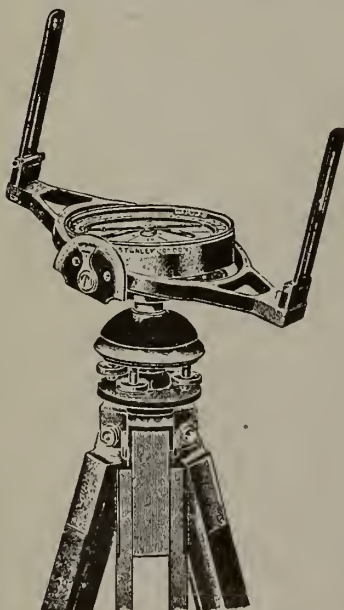
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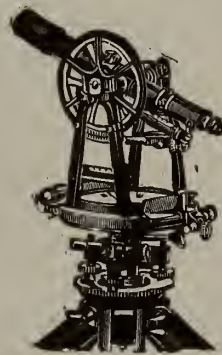
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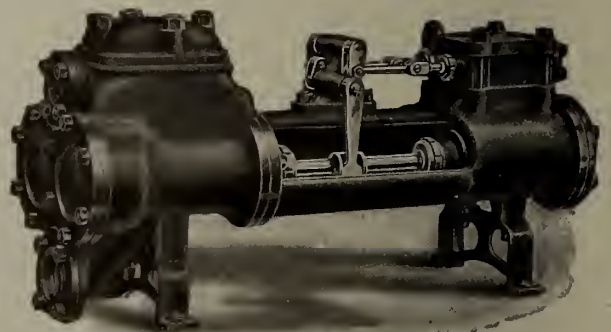
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, May 15, 1916.

No. 10

The Canadian Mining Journal

With which is incorporated the

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Devoted to Mining, Metallurgy and Allied Industries in Canada.

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Editor

REGINALD E. HORE

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CIRCULATION

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EXPLORATION AT COBALT

The high price of silver has naturally led to renewed activity in the Cobalt district. Many properties which have not yet received the attention they deserve will now be subjected to careful examination. It is not unlikely that some abandoned prospects will be developed into producing mines.

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Another structural feature of Cobalt deposits that demands attention is the faulting of the formations in which the ore occurs. In the mine workings very many small faults and a few large faults have been encountered. Some important discoveries have been made during the past few years by studying the fault phenomena. Further study will doubtless result in the location of more ore.

A third structural feature of importance at Cobalt is the relation of the ore deposits to masses of diabase which intrude the other rocks of the district. These diabase masses are in the form of sheets a few hundred feet in thickness. Ore has been mined from the rocks above and below the diabase and some from the diabase itself. Most of the ore mined at Cobalt has been taken from rocks that were probably once covered by the diabase sheet. On the theory that the lower contact is a promising horizon, development at considerable depth is to be undertaken at the Beaver and Temiskaming mines, where the early workings were in rocks overlying the diabase.

The annual report of Hollinger Gold Mines, Ltd., and the report recommending consolidation of Hollinger, Aeme and Millerton, should go a long way towards convincing the public that gold mining in Ontario is a well established industry. The men who are responsible for the development of the Hollinger are to be congratulated on their success. They have converted an hitherto unproductive area of Northern Ontario into a source of millions.

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MINING NEWS FROM THE PAS.

The Pas, Manitoba, May 5.—Messrs. Woods and Stanley Simpson got in from Flin-Flon Monday noon, with diamond drill cores, after a most difficult journey by dogs and canoe. They were twice upset in crossing the ice-strewn lakes between Athapapuskow and Cumberland House. They picked up a lost traveller between Cumberland and Beaver.

Charlie Anwater was another canoe arrival from the sulphide fields near Schist Lake. He says the Tonopah engineers feel greatly encouraged over the early results of the diamond drill operations, and the drill is working at a second hole. Instead of vertical drilling, as was reported, Mr. Anwater declares the drill is being worked on the walls at forty-five degrees.

It will probably be some months yet before the diamond drill operations north of here will prove up the ore-body. No information is given out of the values encountered. However, deals are continually being made on the hope that everything will come out satisfactorily. Prices paid for claims run from fifty to a thousand dollars.

The water route to the sulphide camp is reported clear of ice, and the Ross boat will make the mouth of Goose river on the trip leaving here next Tuesday.

Robert Kerr is arranging a large program of development work on his properties at Herb Lake. He is in control of the Percy and the McCafferty claims, and a lot of work is being planned on these two properties. The Percy has over 400 feet of the famous Rex vein, and free gold shows just as plentiful as upon the other three claims through which it traverses.

Tuesday's train from the south brought a dozen prospectors from Northern Ontario camps. They say more men are coming this month.

M. J. K. Allen and A. H. Corkett, of the public works department of the Provincial Government, went to Herb Lake on Wednesday to make a reconnaissance of the proposed Government road from the railway track to the mines.

The Ottawa Government will not undertake the expense of surveying the boundary line between Manitoba and Saskatchewan, north of 60, to determine the location of Flin-Flon and Athapapuskow Lakes. This information was contained in a letter to the Board of Trade from J. H. Challoner, head of the survey branch of the Department of the Interior. The status of the sulphide ore lakes will remain unknown until the survey is made.

The drilling at Flin-Flon goes on rapidly, and something definite about the extent of the ore-body is expected before the end of the present month. The assay returns have not been made public. Mr. Hammell and associates in the enterprise may be here shortly, and it is possible some information will be secured for publication as to the values encountered by the diamond drill.—The Pas Herald.

HEDLEY GOLD.

At the annual meeting of the Hedley Gold Mining Co., held recently in New York, the directors, with the exception of Mr. W. J. Maloney, in whose stead Mr. W. E. Corey was chosen, were re-elected. The directors and officers of the company now are: Messrs. I. L. Merrill (president), W. B. Dickson (vice-president), C. D. Fraser (treasurer), C. A. Congdon, W. E. Corey, Marcus Daly, F. E. Searle, G. E. Tener, and W. D. Thornton. Mr. J. D. Clarke continues as secretary and assistant treasurer, and Mr. Gomer P. Jones as general superintendent.

TONOPAH AT THE PAS.

The Tonopah Mining Company operates the Tonopah placer mines at Breckenridge, California; Eden mines in Nicaragua, South America; Desert Power and Mill Company in Nevada, and the Tonopah mine at Tonopah, Nevada. More lately the company has taken an interest in the sulphide discoveries north of The Pas and at this time they are testing an ore-body with a diamond drill on Schist Lake. J. E. Spurr is vice-president and advising engineer of the Tonopah, and his assistant in this district is L. W. Gabrecht, formerly in charge of operations in Nicaragua. On the board of directors of the company are national figures in American public life, such as Samuel Bell, of the Washburn-Crosby Flour Mills; C. A. Daniel, on the board of directors of several large railways, and Henry D. Moore. Mr. Spurr is accredited with being one of the foremost geologists of the times. His text books are used at mining colleges and by prospectors and mining men all over the world. His visit to this district last fall subsequently resulted in creating the interest of large mining operators throughout America, who are watching the work of the diamond drills at both Schist and Flin-Flon with marked concern.—The Pas Herald.

YUKON GOLD CO.

During the year 1915 the Yukon Gold Co. acquired additional properties in California and Alaska. The seven dredges in Dawson district, Yukon, were operated for 88.1 per cent. of the season of 147 days, mining 5,041,075 cubic yards and recovering gold to the value of \$2,456,597, or an average of 48.73 cents a cubic yard. The average cost, including depreciation, was 26.46 cents a cubic yard, which was less by 1.16 cents than the cost for 1914. Expenditures totaled \$1,333,908, as compared with 1914. There was a reduction in value of the ground dredged, amounting to 5.48 cents per cubic yard. During the season a total of 380,340 square yards, or 64.7 per cent. of the ground handled, had to be thawed by steam. By hydraulicking in Dawson district, 3,031,647 cubic yards of gravel was washed, this yielding \$412,535, or 13.60 cents a yard. Expenditures on this account totalled \$243,247. The water duty was 6.13 cubic yards per miner's inch. In Alaska (Iditarod), the season lasted 196 days, and there was dredged 926,956 cubic yards, producing gold to the value of \$845,998, an average of 91.3 cents per cubic yard. The expenditure was \$358,407, an average of about 38.7 cents, which was lower by 11.5 cents than for 1914. As a result of better dredging conditions and of the installation of sand elevators, the dredge at Iditarod handled 4,717 cubic yards a day, which was a gain of 1,216 yards over the daily quantity for the preceding season. The three dredges operated in California (on American, Butte, and Feather rivers), together handled 3,818,126 cubic yards of gravel, which yielded \$437,852, an average of 11.46 cents a yard. Expenditure was \$172,118 or about 4.51 cents a yard. The total profit for the year was \$2,121,031; dividends paid amounted to \$1,050,000. Figures of gravel handled and gold recovered, included above, give the following totals: gravel handled, 12,817,804 cubic yards; gold recovered, \$4,152,982.

TWENTIETH CENTURY.

Mr. Anson Gard advises us that work is to be resumed at the Twentieth Century mine, Cobalt district. Mr. Gard will be in charge. The directors of the company are S. Sager, Geo. Laws, L. R. Lupton, E. Spiller, H. A. Ball, David Fritz and J. F. Taylor.

RENEWED ACTIVITY AT COBALT

The remarkable rise in the price of silver during the past two months is now having its effect on the camp. At first there was no general disposition to accelerate production in any way; nor did outside capital find much confidence in silvers. There is now, however, such a general disposition to regard the rise as of some permanence, that there is a very general demand for silver prospects and many old mines are now being opened up.

Silver has never been so high since the Cobalt camp was in being. It averaged 66 cents in 1906 and in 1907 sales were made just over 70 cents. Since that time there have been no sales made above 70 cents. The average price for last year was 49.68 cents, so that if the present basis of silver is accepted there is now an extra profit over the average of last year of between 20 and 25 cents an ounce. This is, of course, not the average for any length of time, yet it seems most improbable that silver will again go below 70 cents, until war conditions have changed. All producing properties are, of course, making much more profit.

Labor is becoming rather scarce and before any agitation had developed, the mine managers representing the majority of the mines in Cobalt, met and decided to share some of their profits with the miners. Accordingly it was decided to grant a raise of 25 cents a day to underground men; the increase to date from May 1st. In addition to this, a bonus of 25 cents will be granted from June 1st. to all employees at the mine, both surface and underground, if silver averages more than 70 cents for any one month. That is to say, if the May average of silver is higher than 70 cents, the companies will pay to their underground miners 50 cents extra and to their surface men 25 cents extra. If the average price for silver in any month falls below 70 cents, the underground men will still retain their advance of 25 cents, but there will be no difference in wage to the surface men. There is some disposition on the part of the surface men to quarrel with this arrangement, but on the whole and for the present, at any rate, it appears to have satisfied the miners.

All the mines which are at present producing in the camp, are making preparations to take out as much silver as they can, while the price is good. The Kerr Lake is pulling very heavily on its old stopes. The Nipissing is preparing to add to its regular production, by mining pockets of low grade ore that would otherwise not have been touched for some time. Also a number of dumps which were mined from open cuts some years ago will be sent to the mill. The Temiskaming and the Beaver are also taking down as much of their high grade ore as they can and production from these properties will be high in the next month. The same may be said generally of the whole camp.

The most noticeable change in the camp is the disposition to open up old prospects. The Crown Reserve Mining Company has taken an option on the Cochrane and is now dewatering it. It is understood that they will adopt quite vigorous mining methods. While the Trethewey has not yet actually started up, nor fixed a date to start up, it is certain that it will be opened up again soon. Exhaustive tests are being made with the ore, in order to discover if it will not be profitable to install oil flotation process at the Trethewey. The Adanac Cobalt now has two veins to work upon, as another vein has recently been found in a winze. The

Gifford Cobalt is experiencing considerable difficulty with water and it will not be possible for them to accomplish much work for some time to come.

During April the Nipissing mined ore of an estimated value of \$167,446, and shipped bullion from Nipissing and Customs ore of an estimated net value of \$447,546. Production is about the same as it was last month, but shipments are very much higher. Mining developments were satisfactory at three points. At the end of April, the drift on vein 490, 112 feet below the fourth level, had been developed 80 feet. The width of the vein has averaged seven inches and the silver contains 1,200 oz. to the ton. To the south the vein is now of good ore, although assays were low for the first 25 feet. Favorable results were also obtained in the winze sunk on vein 102, in 96 tunnel. At a depth of 60 feet in the winze, the vein was cut and it here averages $1\frac{1}{2}$ inches of 1,500-oz. ore. The 81 shaft—the work being conducted to open up the ore on the Cobalt Lake fault—is making good progress. The shaft is now down 485 feet. Some success has been met with in the development at the O'Brien, No. 14 shaft, at the 2nd level. Drifting was commenced on a small vein encountered about a month ago. It is now well defined and contains some Cobalt and has assayed as high as 1,500 oz., over a width of $\frac{3}{4}$ of an inch, but the wall rock carries so well, that the whole drift will assay 50 oz., which is exceptionally high mill rock. Owing to the present price of silver, every effort will be made to take out silver from outlying shafts and dumps.

The favorable results continue to be retained at the McKinley Darragh. In raising on vein 20, some very rich high grade ore has been struck, whereas at the 200-ft. level it was quite low grade. The ore in the raise will run 2,000 oz. over three to four inches. The winze being put down in the foot wall of the Cobalt Lake Fault was stopped at 162 ft.; although it was still in conglomerate. The cross-cut to the north-west is now being undertaken, with the purpose of finding new ore-bodies. The flotation plant at the mill is now ready to run, but is held up by the non-arrival of the press. Directly it arrives and is installed, the slimes will be treated.

The old Red Jacket mine, south of Cobalt, has been leased by Mr. Homer Gibson of Timmins, from the Temiskaming Mining Company and it will probably be worked this year. This old prospect has been closed down for several years. It was reported shortly before it closed down, that high grade ore had been struck at the 100-ft. level, but this was never confirmed and the company went into liquidation and was taken over by the Temiskaming Mining Company. It is learned, however, on good authority, that high grade ore was actually struck and that the property closed down owing to disagreement between the various members of the syndicate controlling the company. As this property is in conglomerate, some distance from any other producing mine, its development will be watched with a great deal of interest.

The Coniagas Mining Company will install an oil flotation plant at their mill. The plant will be installed in place of the canvas tables which are now treating the slimes. The tails from the present cyanide plant will also go to the oil flotation plant.



PERCY A. ROBBINS, M.E.

General Manager, Canadian Mining & Finance Co., Ltd., gold mining and milling, operating Hollinger Gold Mines, Ltd., Acme Gold Mines, Ltd., Millerton Gold Mines, Ltd., Timmins, Ont. Consulting mining engineer. Born in Chicago, May 23rd, 1874, son of James A. and Maria Robbins. Educated at Chicago Manual Training School; Cornell University (graduate in Mechanical Engineering, 1894). First engaged with the Philadelphia Traction Co., Philadelphia, 1894-1895; went to South Africa in 1896, and there with S. Neumann & Co. (Engineering Department), Johannesburg, Transvaal, 1896; occupied various engineering positions in South African Mines, 1897-1898; agent, South African General Electric Co., Durban, Natal, 1899-1900; consulting engineer and at times acted as general manager, DeBeers Consolidated Mines, Limited, South Africa, 1900-1904; during this time also acted as Examiner of Engineering Classes, University of the Cape of Good Hope, and acted as consulting engineer to the Indwe Collieries and Imperial Cold Storage Co., DeBeers Explosive Works, 1905-1907; practised as a consulting engineer in New York City and engaged in contracting in pneumatic caisson work; general manager, McKinley-Darragh-Savage Mines, during which time reorganized the company and put the mine on solid financial basis, 1908-1911; appointed general manager of Timmins-McMartin-Dunlap interests, now incorporated as Canadian Mining and Finance Co., Ltd., and controlling Hollinger Gold Mines, Acme Gold Mines and Millerton Gold Mines, Ltd. Married Sophie K. Snowell, September 9th, 1904; has two sons (James S. and Frederick Peter) and two daughters (Helen and Ruth). Clubs: Rocky Mountain and Engineers (New York); Engineers' (Toronto). Technical Societies: Institute of Mining and Metallurgy, London; Canadian Mining Institute; Mining and Metallurgy Society of America; American Institute of Mining Engineers; American Institute of Electrical Engineers. Anglican. Residence, Timmins, Ont.

Mr. Charles Spearman, of Haileybury, has been appointed manager of the Renfrew Molybdenite Mines of Mount St. Patrick, a company controlled by the Algonican Development Company. This company has a deposit of molybdenum twenty miles south of Renfrew. The property was taken up some time ago, when the demand for molybdenite was not very keen and it was soon closed down. Owing to the increased demand and direct contracts with the British Government, the company became active again and two carloads of ore have been taken out, with a view to immediate concentration.

Mr. G. C. Bateman has been appointed general manager of La Rose Consolidated. Mr. Bateman has been lately acting as field engineer for the company and among other duties has been looking after the development of gold property in Deloro which the La Rose Company has under option.

Mr. R. B. Watson has resigned his position as general manager of La Rose Consolidated. Mr. Watson is general manager of the Nipissing Mining Company.

Walter Harvey Weed, E.M., the copper geologist and publisher of the "Copper Handbook," has become managing director of the Crystal Copper Company, with a capitalization of \$1,000,000, to take over the Crystal copper mines in the Cataract mining district, Jefferson county, Montana, near Basin, on the Great Northern Railway. The properties are 30 miles east of Butte, along the Butte granite formation, and have been operated in a small way for 2 years. Mr. Weed recommends building a mill and doing deep development work, and will expend \$100,000 in this way during the present year.

With Mr. Weed on the board of directors is Paul Gow, E.M. formerly consulting engineer of the Pilot-Butte mines of Butte, which recently passed ownership to Anaconda at a price of \$1,100,000. The Pilot-Butte properties consist of only five acres in the northern section of Butte Hill and are considered to be the highest priced mining ground ever sold—over \$200,000 an acre. By the transfer the Apex law suit between Anaconda and Pilot-Butte, over the latter's Gow vein, was settled. Mr. Gow will be associated with Mr. Weed in the direction of the Crystal copper mines.

The financing of the new company is being done by the John E. Allen & Co. copper interests of Boston.

PACIFIC COAST COAL MINES, LTD.

At a meeting of shareholders in the Pacific Coast Coal Mines, Ltd., operating coal mines at South Wellington, and Suquash, Vancouver Island, British Columbia, held at the company's head office in Victoria, B.C., on April 8th, some well known Montreal financial and business men were elected directors, and at the meeting of directors which followed, Mr. James Carruthers, of Montreal, president of the Canada Steamships Line and director of the Dominion Bank of Canada, was elected president; Mr. J. H. Paine, managing director of the Canada Securities Corporation, Montreal, vice-president, and Mr. John H. Tonkin, of Victoria, managing director. The other members of the board are: Sir Thomas Tait, Montreal; Mr. C. A. Barnard, K.C., Montreal; Mr. F. B. Pemberton, Victoria, and Mr. Talbot Schmuck, secretary-treasurer, Victoria.

THE MINING INDUSTRY OF BRITISH COLUMBIA

Victoria, B.C., March 28.—The Budget speech by the Minister of Finance, Hon. Lorne A. Campbell, was delivered last night in the Legislature. The review of the conditions through which the Province has passed in the last year, and the prospects for the future, was listened to with great interest by the members, as well as a large number in the galleries. The speech breathed optimism, showing, as it did, that British Columbia, with its enormous resources, its limited indebtedness, and the prospects for still greater development under the progressive policies of the Government, had nothing to fear, but everything to hope for in the future.

Regarding the mining industry of the Province Mr. Campbell said:

It is worthy of note that the total value of the mineral production of British Columbia for all years has now passed the \$500,000,000 mark; the official figures show that the total at the end of 1915 was \$516,122,000. This industry is progressive, without doubt, notwithstanding that the world-wide demoralization of the metal markets seriously and adversely affected mineral production in this Province during the latter part of 1914 and the earlier months of 1915, for the total value of the 1915 production was within \$3,141,000 of that of 1912, which was the highest year on record; and less than \$1,000,000 short of that of 1913, the only other year of higher total value.

Taking metalliferous mining alone, the value of its production in 1915 was greater by \$2,677,000 than that of any other year in the history of mining in the Province. This was not due to any considerable extent to higher average prices of metals, but largely to the substantial increase in the production of copper, the mining of which metal is becoming increasingly important in British Columbia as the years pass.

This is what Mr. George L. Walker, of Boston, writer of Walker's Weekly Copper Letter, which is published every week in The Boston Commercial, wrote last month of the **Granby Consolidated Company**: "Those who are interested in the Granby Company should fix their attention on the Anyox, or Hidden Creek, end of its business. There the company has expended more than \$5,000,000 in the purchase and development of properties and in the erection and equipment of modern smelting works which have a capacity to smelt approximately 1,100,000 tons of ore a year. Although work has been going on there only about three years, the company has developed around 10,000,000 tons of ore that contains forty-two to fifty pounds of copper to the ton and from which will be recovered in the coming ten years between 370,000,000 and 400,000,000 pounds of copper. In addition, the company has developed approximately 10,000,000 tons of ore containing slightly less than twenty pounds of copper to the ton. It also has 3,000,000 or 4,000,000 tons of siliceous concentrating ore, averaging about forty pounds of copper to the ton, not yet included in any of its estimates of ore reserves. There is every reason to expect that within the next year the Granby Company will be producing at the rate of 35,000,000 or 40,000,000 pounds of copper annually at Anyox. There is no reason to doubt that it will be able to maintain such an output for a great many years."

As indicating the promising future there seems to be for copper mining, it may be pointed out that on March 4 Mr. Walker published the statement that "While it is hardly to be expected that copper will

continue to sell at 28c a pound over a long period of years, that the price will average nearer 20c than 15c during the coming decade is by no means an unwarranted estimate."

At the end of February there was published in New York City a statement that the secretary of the Howe Sound Company, which controls the **Britannia Mining and Smelting Company**, had said that "By April the Britannia mine will be producing at the rate of 3,000 tons of ore a day." It was added that it had been officially stated that the average copper content of the ore going through the concentrating mill was better than 3 per cent., with 90 per cent. or fifty-four pounds of the copper to the ton, being saved. It may be safely figured, the report continued, that the annual production, beginning in April, will be at the rate of fully 1,000,000 tons of ore per annum after allowing for shutdowns, accidents, etc., or 54,000,000 pounds of copper per annum.

As it is known that an output of 3,000 tons a day by no means represents the maximum limit of the company's production plans, it appears quite reasonable to conclude that a year or two hence the Britannia Company alone may be expected to be producing as much copper as was produced in 1915—the year of highest copper production in the history of mining in this Province—from all the mines in British Columbia then operating.

What more striking evidence of the prospective great future of the metalliferous mining industry of British Columbia could be desired than that afforded by the progress of copper mining in what is generally spoken of as the Coast district, which includes mines about Hazelton and in mining divisions tributary to Prince Rupert, as well as the lower Coast mines? Forecasts by men in Boston and New York having first-hand information to guide them—the head offices of both companies being in New York—indicate a reasonable expectation that in the immediate future the Granby and Britannia mining companies will, together, make a production of fully 90,000,000 pounds of copper a year. Add that of comparatively small mines near Hazelton and on Queen Charlotte and Texada Islands, and other Coast localities, and it is a quite moderate estimate to look for a production in the near future of 100,000,000 pounds of copper a year from Coast district mines. Now, take the production of these mines during the last ten years: For five years, 1906-1910, the total was 15,562,000 pounds of copper, or an average of approximately 3,112,000 pounds a year. For five years, 1911-1915, it was 89,389,000 pounds, or an average of 17,878,000 pounds a year. In comparison with this we have (if the estimates quoted may be depended on, and there is good reason to think they may be) a reasonable expectation of a production of copper in a single year nearly as large as that of the ten-year period for which figures have just been given.

In degree, the outlook for increased production of other metals is also promising. Already there is improvement in both Atlin and Cariboo districts, whence comes most of the placer gold recovered in British Columbia, and when the latter district shall have the benefit of the greatly improved transportation facilities that the Pacific Great Eastern Railway will afford it, so that mining machinery, plant and supplies may be taken in at a much lower cost than is now practicable, there should not be any doubt that mining there will receive a great impetus with large and important results. More lode gold will also be produced in British Columbia, for mining in **Rossland camp**, the big-

gest gold-producer in the Province, is on a better basis and larger scale to-day than in past years, while provision has been made at Hedley for increasing the output of gold from the big mine in that camp. In the Coast district, too, greater production seems assured, for, beside that of the Granby Company, there will soon be lode gold production at the Surf Inlet mine.

As to **silver, lead and zinc**, which metals occur largely together in ores in Ainsworth, Slocan and East Kootenay districts, the general activity in those districts gives assurance of marked progress and increased production of these metals. Standing out prominently in this connection is the enlargement of the operations of several companies and notably of the Consolidated Mining and Smelting Company, with its **electrolytic zinc plant at Trail** about complete, and a beginning being made with other important additions there.

A word or two concerning improved processes for recovery of metals. Years ago the Consolidated Company established at Trail its electrolytic lead refinery. Now the electrolytic refining of zinc there on a commercial scale may be regarded as an accomplished fact; preparation for the manufacture of sulphuric acid is stated to be well advanced, while the electrolytic refining of copper will soon follow. **The flotation process in ore concentration** is in successful operation; at the Britannia mill on copper ores and at the mill of the Silvertown Mines, Limited, Slocan, on silver-zinc ores; while experiments are being continued elsewhere in the Province. Modern gold extraction methods have been successfully adopted at Hedley and other mills. Attention has been turned, too, to the recovery of molybdenite in the Province.

Then as to **coal**. In the Crow's Nest district, South-east Kootenay, extensive new areas of coal have been opened and provision made for a greatly enlarged output of coal whenever market demands shall call for it. The saving of by-products from the manufacture of coke is also having the serious attention of one company operating on a large scale. On Vancouver Island several new coal mines have been opened and equipped in quite recent years, and here, too, provision has been made for a very much larger production of coal. It is encouraging, too, to note that the manufacture of coke has again been undertaken on the Island after the coke ovens had been unused for a number of years.

SILVER.

Commenting on the silver situation the Boston News Bureau says:

Production of silver on the North American continent continues to show a smaller yield than in normal times owing to the practical cessation of production of this metal in Mexico. With greater activity among the copper, zinc and lead producers of the United States there has been an increase in silver yield as a by-product, but this has not been sufficient to offset the smaller quantity coming from the rich Mexican mines.

During the first quarter of the year London imported 21,000,000 ounces of silver, whereas in the first three months of 1915 the receipts at that centre were 25,500,000 ounces. It should be clearly understood in this connection that London absolutely dominates the silver market of the world. The exportation of silver from London in the first quarter of 1916 amounted to but 12,000,000 ounces against 21,000,000 ounces last year in the corresponding period. Of the amount shipped from London up to the end of March 6,000,000 ounces were for France, a most unusual occurrence, leaving but 6,000,000 ounces to be shipped to regular customers compared with 21,000,000 ounces last year.

London's best customer for years has been India, where large quantities of the metal go into coinage. Notwithstanding this position there was shipped to India in January, February and March last, but 3,000,000 ounces comparing with 15,000,000 ounces in the first quarter of 1915.

Except for the two years following 1890, which marked the end of the silver boom and the height of the free silver agitation, silver the metal, has never been so high as it is to-day. The New York price of 77¾ cents compares with the average price this month a year ago of 49.91½ cents, and an average of 49.69 for the entire 1915 year. Silver authorities do not care to hazard a guess where the advance will culminate under present conditions. The Mexican production which showed a drop of 9,000,000 ounces last year, or from 26,000,000 to 18,000,000, is still being interrupted and Australian supplies are being cut down. But demand, not supply, is the real factor. There is a heavy demand for coinage purposes in Great Britain and Europe. The Bank of England is carrying practically the smallest silver reserve in its history and must replenish its stock soon from an English floating supply which is hardly 15 per cent. of normal. China, which is standardizing her monetary system has been a big buyer. Curiously enough, India, which is ordinarily a big consumer has not taken a third of the amount of last year. In view of the extraordinary demand which gives every indication of continuance, a selling level of 80 cents for the remainder of the year would not be surprising to some experts.

ACTIVITY IN THE YUKON.

A press despatch from Dawson, Yukon territory, dated May 1st, was as follows: The ice in Yukon river is breaking up in many places between Whitehorse and Dawson. It is expected that the river will be clear in front of Dawson within ten or twelve days. The winter season has been prolonged later than usual, but the weather has now suddenly become warmer. All the Yukon dredging fleet will soon be under way as soon as the ice disappears and allows running water for working the low-grade placer-gold mines. Some of the dredges are already operating.

Steamers at all points on the Yukon river are being prepared for opening of the season of summer navigation along its length of 2,000 miles. River steamboats at Whitehorse and Lake Lebarge will be ready to sail as soon as the ice shall be out of the way.

Dawson markets are still well supplied with everything needed except butter, sugar, and onions. Butter is particularly scarce. Onions are nearly all gone. An unusual crop of native potatoes of excellent quality is responsible for the slow sale of imported potatoes.

A press despatch from Fairbanks, Alaska, states that half a ton of tungsten concentrate has been sent from that place to Philadelphia by parcel post. The rate charged by the Post Office Department is 12 cents a pound, while the Express companies charge 50 cents a pound to Cordova. It was expected that every mail leaving Fairbanks for the remainder of the winter would include several hundred pounds of tungsten concentrate, for the mail contractors are required by the terms of their contract to carry 1,600 pounds of mail matter every trip, and since there is nothing like that much weight of ordinary mail leaving Fairbanks, the difference is to be made up of concentrate as above stated.

UNIVERSITY NEEDS OF THE MARITIME PROVINCES

By F. W. Gray.

The "Journal of Commerce" last month published an editorial, presumably from the pen of the Hon. W. S. Fielding, on "Maritime Universities," suggested by a recent address to the Moncton Canadian Club by Dr. Stanley McKenzie, President of Dalhousie University. This address, Mr. Fielding writes, has revived the question of university consolidation discussed keenly a few years ago in Nova Scotia. He takes a broader view, and certainly a wiser one, and pleads for the creation of one strong central University, for the Maritime Provinces, one, to quote Mr. Fielding, "that can take its place in comparison and competition with the large institutions of Ontario and Quebec."

Dr. McKenzie deplores the existence of the smaller universities "to the exclusion of one really strong University, on many grounds, but none so important as the fact that none of them can afford such expensive scientific equipment in men and appliances as will enable us to keep abreast of the Germans, and of the Swiss, and of the Australians, and of almost every other community."

Mr. Fielding remarks that university consolidation is likely to find more sympathizers west of the Restigouche river than east of it, and that while to the reader at a distance Dr. McKenzie's arguments seem so strong as to be conclusive, yet down east, among the people most concerned, it will receive only a moderate support.

It is to be feared that Mr. Fielding's appraisal of the situation is substantially correct—the more the pity that it should be so.

Technical training is the greatest educational need of the Maritime Provinces, and modern technical colleges need most expensive equipment, equipment that is absolutely beyond the financial resources of the individual denominational colleges, and possible of procurement only by a consolidation of interests.

It is not too much to say that the possibilities of the economic development of the Maritime Provinces are largely bound up with and dependent upon the opportunities for technical knowledge that are available to the college graduates of these provinces.

The extensive seaboard of the Maritime Provinces, the commodious and ice-free harbors on the south-eastern shores, and the central geographical position occupied by these provinces, would in any case have marked them out as the centre of great commercial and shipping activity, but the possession of coal deposits of good quality and accessibility, situated on the seaboard of a territory singularly devoid of coal resources, combined with the presence of iron ore deposits of similarly good quality and accessibility within easy reach, at once compels an analogy with other maritime nations having coal and iron resources, such as Great Britain, Germany and Japan, each of them a synonym for rapid industrial development and the growth of material wealth.

That the Maritime Provinces have not developed their commercial and manufacturing possibilities does not mean that there are any insuperable difficulties in such development. These provinces comprise the seaboard, the outlet of a vast hinterland, which up to the present has been more concerned with the absorption of men and materials for its development than with the distribution of its natural wealth. Signs are now

appearing that the day of the Maritime Provinces is beginning. The completion of two great transeontinental railways to their logical termini on the eastern shores of Canada, the large expenditures now being made on terminals at Halifax and St. John, point to the time when the great and developing territory to the west of the Maritime Provinces will discharge its surplus natural resources at the only place on the eastern shores where it is possible to transport them by sea throughout the whole year.

It is evident, therefore, that the future of the Maritime Provinces lies in shipping and manufactures, that agriculture will advance as urban populations arise to supply a profitable market, and the basic factor in manufacturing activities will be coal production.

A summarized list of some of the industries that are either in existence at the present time, or are possible in the Maritime Provinces, will include the following:

Mining.—Coal, gold, iron, the ores of such metals as tungsten and antimony, barytes, oil-shales and natural gas.

Sandstones for building. Granites for building and paving. Limestones and dolomites. Gypsum. Grindstones.

Clay Products.—Bricks, drain and sewer pipes, and rough earthenware. Fireclay.

Manufactures.—Iron and steel, with finished products, and the fabrication of structural steel, for bridges, buildings, etc. By-products of the steel and coal industries, as bricks, cement, sulphate of ammonia, and the chemical products of coal-tar distillation, including high explosives. Textiles, clothing and caps. Leather products and shoes. Manufactured lumber and finished woodwork. Railway cars, steel and wood. Machinery, including electrical appliances. Agricultural and mining tools. Gas and oil motors. Motor cars. Horse vehicles. Shipbuilding and repairing. Munitions of war.

Agriculture.—Fruit farming. Dairy farming on the co-operative principle, combined with stock raising and rearing of sheep and horses. Market gardening for home consumption. Scientific forestry. Bee farming and fur farming.

Fisheries.—Fish for home consumption and export, lobster canneries and factories for curing, preserving and special preparation of fish.

Transportation and Communication.—Railways, shipping, telegraphs and telephones, ocean cables and wireless plants on the seaboard.

The Maritime Provinces are therefore in possession of all the natural resources for the maintenance of a large population for the establishment of manufacturing for export trade, and for distribution not only of manufactured articles made in these provinces, but those which coming from the populated West will find their natural outlet from the ports of Nova Scotia and New Brunswick. In many respects these provinces resemble Great Britain, and they have many of the same characteristics which have helped to make of Britain a great maritime, trading and manufacturing nation. Also these provinces are as yet chiefly populated by descendants or members of the same northern races that have made the great nations of Europe, and the nature of the climate tends to the perpetuation of

a virile and enterprising people. The Maritime Provinces have from their first founding contributed largely to the learned professions of Canada, and the graduates of their universities are to be found in the theological, medical and legal circles of Canada from Montreal to Vancouver. These provinces have also contributed in an almost disproportionate manner to the legislators and politicians of Canada, and many of the brightest intellects produced by the three provinces of the East have, for lack of scope in their native country, gone to the United States and there achieved eminence. But, if as seems to be the case, the future of these provinces lies in industrial activities, it would appear advisable that the universities of this portion of Canada should devote their efforts to fitting men to create and guide these industries rather than train young men for the already overcrowded learned professions.

For the development of all possible industries before cited, men possessing exact scientific knowledge and acquainted with complex technical processes are needed. At the base of all operating manufactures is the man of scientific research. Modern manufacturing processes are complex in the extreme, and they have been perfected not by lucky discoveries, but by long and laborious research, originating in many instances from pure scientific deduction in the laboratory or the study.

A striking instance of the economic value of scientific deduction, is the geological reasoning which led to the discovery of coal on the eastern border of the Midlands coalfield in England. From certain indications noticed to the north of what had been for years regarded as a purely agricultural district, geologists suspected the existence of a fold in the paleozoic floor which would bring the coal seams, hitherto supposed to be buried at inaccessible depths beneath newer formations, within the limits of mining. Boreholes proved the correctness of this reasoning, and to-day there is every possibility that the Midlands coalfield is twice the area formerly assigned to it, a conclusion that is of momentous importance to England. Similar deductions have led to the discovery of concealed coalfields in the Lippe valley in Germany, in the Campine district of Belgium, and in Kent, England.

Men capable of exact research work can be produced only by university training, and in the Maritime Provinces it will not be possible to provide adequate technical education for the active participants in industry, until the universities are able not only to produce large numbers of trained men, but are also able to become centres for a university extension work, in which the faculty and equipment of each college becomes available for the dissemination of scientific education among the workers themselves.

Two outstanding features in modern industrial development are the value of the so-called by-products of a basic industry, such as coal mining and iron and steel manufacturing, and the interdependence of the various branches of manufacture one upon another, and their combined effect upon agriculture. It is now a truism that the profits of many industries are obtained from their by-products and from the complete utilization of all the raw materials.

A classic and oft-quoted example, but one not yet fully comprehended by the public at large, is the possibilities of the complete utilization of all the products of the destructive distillation of coal, whether this distillation takes place in its crudest form, namely, the

use of coal as a fuel for heating or steam raising; in coke ovens; in the manufacture of lighting gas, or in any other of the many forms in which coal is burnt to secure its heating value. In the ordinary operation of raising steam by burning coal under a boiler, by far the most valuable portion of the coal is wasted in the form of smoke and soot.

At many collieries in Europe to-day the power which operates the mine machinery is obtained for nothing—in fact, for less than nothing, as the yield from by-products is greater in value than the cost of the fuel used. Coal is distilled in gas producers, and from the resulting products is obtained sulphate of ammonia, tar and pitch, crude oil and some benzol. The residual gases are either burnt under boilers to raise steam for the operation of turbo-electric generators or they are utilized in gas engines combined with electric generators. Thus a curious reversal of the old practice has resulted. The modern plant is designed to extract what are called “by-products,” and the waste gases are used to generate power. In this case, what were formerly considered as the by-products are now become the main object of the process and the generation of power has become a mere off-shoot of the recovery of the distillation products of coal.

It is not a fairy tale of science, but sober and profitable practice now being realized in many parts of the world, that large territories can be supplied with cheap electric power from a plant of great capacity situated at the pit mouth, designed with a main view to the profitable extraction of coal distillation products and the generation of high electric voltages by gas-fired boilers or the use of gas engines. By the use of heavy voltages, say pressure of 100,000 volts, there is no practical limit to the territory that can be supplied with electric power at a price as low or below that rendered possible by the best water powers. If such a scheme were to be applied to Nova Scotia it would revolutionize both manufacture and agriculture. Electric power can be applied to the operation of light railways and agricultural machinery so as to provide the cheap transportation and the motive power that is so pressing a need in agriculture in a country where farm labor is difficult to obtain and the climatic conditions require the cultivation of the land shall be carried out within the minimum time. The development of the co-operative idea in dairy farming that has been so successful in Denmark would be greatly stimulated by the availability of cheap electric power for use in central creameries.

A prosperous dairy industry will create a market for such nitrogenous fertilizers as sulphate of ammonia, which will make productive meadows of poor pasture land. Properly conducted dairy farming includes, of course, stock raising, which in its turn leads to tanneries, shoe manufactories and leather industries. Sheep raising can be combined with woolen textile manufactories, and all these interdependent potentialities of the Maritime Provinces can be made feasible and profitable by the provision of cheap electric power.

Regarding agriculture. There is just as much need for technically trained men, as in the industries of mining and manufacture of raw materials. It is an extraordinary fact, and although often referred to it will bear repeating, that such prosperous industrial districts as are to be found in Cape Breton are dependent for their dairy produce, meats and green vegetables very largely on sources outside the Maritime Provinces. Upon several occasions when there

have been extended interruptions to the I. R. C. ferry at the Strait of Canso, this has been followed by a shortage of fresh meats and dairy produce in Cape Breton, and during the last two years a large amount of butter has been sold in the Island which was exported from New Zealand. There is no need to labor these self-obvious facts. The peninsula of Denmark, which has a winter climate that is almost as rigorous as that of Nova Scotia, has, by a system of co-operative creameries and by the application of scientific principles to agriculture, developed an export trade in butter, cheese, eggs and poultry, which is now the main source of Denmark's prosperity. The Government-aided Agricultural Colleges in existence in the Maritime Provinces are doing an excellent work along these lines, but there is room for a much more extensive work. What is true of dairy farming is equally true with regard to stock raising, and such incidental but profitable accompaniments of agriculture as bee farming and the raising of fur-bearing animals.

The conservation of the fisheries of the Maritime Provinces, of the lobster industry and the oyster beds, are matters which call for expert technical knowledge.

The oil-shales of Nova Scotia and New Brunswick are an asset as yet untouched. Some of these shales when retorted have yielded from 30 to 80 gallons of crude oil, and from 65 to 112 pounds of sulphate of ammonia per ton. The dense crude oils, when further treated, yield lubricating oils, burning oils and paraffin wax, and the process of refinement may be carried along to produce naphtha, benzol and their innumerable derivatives. In Scotland, very similar shales, no richer in oil and sulphate have been profitably mined, retorted and distilled for many years.

Regarding forestry, a reconnaissance was recently made by Dean Fernow of the University of Toronto, into the forest resources of Nova Scotia and Cape Breton, who asserts that if the whole green forest area of Nova Scotia of, say, six million acres, were managed like the Prussian Government forests, an annual output of more than twice the present one could be had forever, or that we have here a natural resource capable, under proper management, of forever producing, by annual increment, as interest, at least twice as much as is now being cut from capital stock; a resource which basing its value on reasonable rates of growth, both of wood and wood values, may reasonably be stated as representing a potential capital of at least \$300,000,000. If this is true of Nova Scotia, how much greater are the capital potentialities of the New Brunswick forests?

It has lately become the fashion in certain circles not renowned for intellectual profundity to decry the German methods of technical education. The German is represented as a creature capable of incredible labor, but so immersed in scientific detail that he has lost the faculty of initiative, has lost his sense of proportion and the imagination that leads to great inventions. Maybe this is the case, but has not the German shown some little ability in science and invention? To say nothing of the misdirected genius that has produced the Zeppelin, the forty-two centimetre howitzer, the super-submarine and other devilish contrivances, concerning which it is no disgrace to admit that we have followed and not led the way, what about the applied science that has hitherto enabled the Central Empires to live, yea, almost to flourish, despite the Allies' blockade? Could any nation have accomplished the things

that Germany has accomplished had she not had ready to hand a nation of workers, trained not only in war, as we have proved to our cost, but trained in economic processes at which it is easier to poke fun than to emulate?

At a recent meeting of the Dusseldorf Eisenhutte, a Herr Daelen indulged in some perspicacious criticism of British methods in the steel industry. Herr Daelen said:

"Managers and officials (of steel works in Britain) are insufficiently educated. Works managers are lacking in technical as well as in general preparatory education, and were, in so far as the latter point was concerned, mostly foremen whose natural gift was their best property. The technical high schools in England were not equivalent scientifically to the German high schools, as they were rather intermediate schools. Technically, the English methods of working could not be compared with the German, they being backward in all branches."

Allowing for the inevitable bombast of the Teuton and its accentuation at this particular time, there is nevertheless sufficient truth in these remarks to leave a very perceptible sting in the minds of those who read and do not allow their prejudices altogether to cloud their judgment.

If such criticism can be made of English steel works, and the Navy is sufficient proof that there is some technical knowledge even in a land that is not yet blessed by the full-orbed beams of German culture, where do we stand in the Maritime Provinces?

Why should not the Maritime Provinces, containing as Dr. McKenzie says, a million people "without a strong University"—why should not these provinces—so potent in their latent possibilities—have an institution comparable to the Boston "Tech.," or to McGill University? Is there, asks Dr. McKenzie, "another group of a million in the whole civilized world in a similar predicament?"

Therefore, it is with a feeling of sorrow that one reads the conclusions of Mr. Fielding—who should know his Maritime Provinces as well as most men—with reference to the question of university consolidation and the small colleges, that "the feeling of local and denominational pride behind them is so strong that it will over-ride, as it has in the past, the arguments advanced by Dr. McKenzie." And we are constrained to add, "So much the worse for the Maritime Provinces."

A PLACER STRIKE ON NELSON CREEK.

News has just been brought to Whitehorse of a rich placer strike having been recently made on Nelson creek, a tributary of Mayo lake, in the upper Stewart river country. The discoverers were Big Steve and Little Steve, who have been prospecting there for a long time.

Rev. F. H. Black, rector of the Anglican church at Dawson, and Chester Thomas, the well known mining man of the same city, lately returned to Dawson from the scene of the strike and confirm the good reports previously brought out. The creek is said to be from 15 to 30 miles long and already there are 40 to 50 claims staked. The discoverers got one pan which went 16 cents. There are several outfits now prospecting on the creek.—Whitehorse Star.

SUDBURY NICKEL-COPPER DEPOSITS

In an article on the origin of the Sudbury nickel and copper deposits Mr. C. W. Knight says in the May 6th number of *The Engineering and Mining Journal*:

"The Creighton orebody is the most important and largest nickel deposit in the world and one of the greatest metalliferous mines of any kind. It is considered by certain workers to be the example par excellence of the magmatic-segregation theory. It occurs at the contact of granite and norite and dips at an angle of about 45 deg. to the northwest. Granite forms the foot wall, norite the hanging wall. The theory of magmatic segregation postulates that the sulphides—the heaviest materials of the molten norite—settled to the bottom of the norite and rested on the granite foot wall. This explanation is wholly untenable. Why, may be briefly stated.

"The granite foot wall forms a great, coarse-grained intrusion 13 miles long and 2 to 3 miles wide. Field work by the writer during the past year has shown that it is younger than the norite, not older, as has been assumed by the magmatic-theory advocates. Dikes of the coarse-grained granite penetrate the norite. Hundreds of them have actually been counted. The age relationship is so clear that it would be unnecessary to emphasize the fact had it not been denied. The granite dikes can be traced foot by foot into the norite. They penetrate it hundreds of feet. The exposures are often unsurpassed for the purposes of the geologist. There are also small, fine-grained granite dikes intersecting the granite itself, but they have nothing to do with the question. Clearly then, since the granite is younger than the norite, the molten sulphides could not have settled to the bottom of the norite magma and rested on the granite foot wall, for the very good reason that the granite was not there when the norite was erupted.

"The age relationship of the rocks and orebody is as follows: A great mass of norite penetrated a complex composed of schistose sediments and igneous rocks. The complex and norite were invaded by granite which now forms the foot wall of the Creighton orebody. Then came a period of ore formation, during which solutions circulated along and near the contact of the granite and norite and deposited the nickel and copper sulphides which form the orebody. The relationship may be briefly given in the following table, the youngest materials being shown at the top:

Pre-Cambrian

Period of ore deposition from solution.
Intrusion of coarse-grained granite.
Intrusion of norite, cutting complex of sediments and igneous rocks.

"A second mine, the Worthington, may be mentioned. This orebody is simply a brecciated basic dike. Solutions circulated along the interstices of the fragments and blocks and deposited the nickel and copper sulphides in these interstices. Even the supporters of the theory of igneous origin were compelled to recognize that this nontypical Sudbury deposit was not wholly of magmatic origin.

"At the Frood, or No. 3 mine, where 30,000,000 tons or more of ore is said to be available, the ore occurs largely in schistose beds of greywacke and to a less extent in norite or gabbro. The maps of the area incorrectly show the deposits to occur wholly in norite or gabbro. The greywacke has been crushed and brecciated, and along this zone, solutions have deposited their

burden of nickel and copper sulphides. Some sulphides also impregnate the intrusions of basic rocks. Knowing now the structural and age relationship of the rocks and orebody at the Creighton mine, there is no authority for assuming that the ore of the Frood is of igneous origin.

"The fallacy of certain general arguments that have been advanced to support the theory of magmatic segregation may now be briefly pointed out. It has, for instance, been stated that norite and ore are mixed in every degree and that spotted norite may occur long distances from orebodies. And it has been argued that, because the ore minerals are intimately intergrown with the original minerals of the norite, their magmatic origin is hardly to be questioned. But the sulphides also mix in every degree with granite and greenstone, the former of which is younger than the norite, the latter older than the norite. The granite and greenstone are also spotted with sulphides in a similar manner to the spotted norite. The spotted granite, greenstone and greywacke seem to have escaped the notice of investigators, who have considered the spotted norite to be evidence of the magmatic origin of the orebodies. Thus, following this reasoning, the ore in the granite and greenstone would be also of magmatic origin. But the theory is seen to be even more impossible when it is pointed out that the ore mixes in every degree with greywacke. Obviously the ore in the greywacke is not of magmatic origin. There are other points regarding the origin of the Sudbury nickel-copper ores, not touched on in this paper, that will be dealt with in a forthcoming publication and further evidence in support of the theory that the ores were deposited from solutions which probably emanated from the norite will be given."

CONCENTRATION BY FLOTATION.

In paper presented by F. G. Fuchs at the recent Pan-American Scientific Congress the author deals mainly with experiments to determine to what extent the phenomena of concentration by flotation are due or can be related to capillarity. To this end, he ascertained the adhesive action of oil on different minerals. He found that some minerals, among them quartz, limestone, mangano-siderite, and alabaster, were not wetted by oil, while others, mainly galena and chalcopyrite, were strongly wetted, it being almost impossible to remove the adhered oil even by vigorous rubbing with a cloth. In his principal experiments he used a glass beaker nearly full of water, on the surface of which he poured oil to form a 5-mm. layer. He then placed on the surface small fragments of the various minerals. The results were: (1) Some minerals, especially quartz, fell through the oil layer to the bottom, carrying with them some oil, which, however, soon detached itself and rose, leaving the mineral clean; (2) others, especially galena and chalcopyrite, sank to the bottom but remained enveloped by an oil layer; (3) others, among them blende and iron pyrites, are intermediate between (1) and (2). They carry some oil with them, which they retain if quiescent, but if shaken lose it. When the minerals are pulverized and mixed to a paste with water and oil, and then gently dropped on the oil surface as above, those of class (1) go to the bottom and those of class (2) are held by the oil layer. These phenomena do not occur unless the mineral is wet with water; if it is perfectly dry, all minerals behave like those of class (2).

THE BOUNTY ON ZINC OR SPELTER

On April 19th, 1916, Hon. Sir Thomas White, Minister of Finance, moved that the House go into committee to consider the following proposed resolution:

"Resolved, that it is expedient to authorize the payment out of the Consolidated Revenue Fund of a bounty of two cents per pound on zinc or spelter, containing not more than two per cent. of impurities, produced in Canada from zinc ores mined in Canada; provided the standard price of zinc or spelter in London, England, at the time of production is less than £36 19s. 3d. sterling per ton of two thousand two hundred and forty (2,240) pounds, when the bounty payable shall be an amount equal to the difference between such standard price per ton and £36 19s. 3d. per ton. Further provided, that in no event shall bounty be payable when the price received for zinc or spelter by the producer is eight cents or more per pound, and that no bounty shall be payable on zinc or spelter to the producer during the continuation of the war, and in no event on zinc or spelter produced after July 31st, 1917.

"Further resolved, that the total amount payable under the provisions of any Act founded on these resolutions shall not exceed the sum of \$400,000."

He said: It may be helpful to the committee if I give a brief explanation. Provision is made for the payment of a bounty not exceeding two cents a pound on zinc or spelter produced in Canada from zinc ores mined in Canada. The legislation will not apply when the price received for zinc by the producer is eight cents or more per pound. It will not apply during the period of the war, or after July 31st, 1917. That is to say, the legislation is confined to the period between the termination of the war and July 31st, 1917. This legislation is in pursuance of a promise which was given by the Government in August of last year to producers of zinc in Canada with the object of providing for the refining of pure zinc in the Dominion. An extraordinary condition prevailed at that time, and, as a matter of fact, still prevails. After the outbreak of the war an unusual demand arose for zinc. To give the committee an idea of the character of that demand, I may say that in 1914 the export of zinc in pigs, bars, plates and sheets from the United States amounted to only 4,000,000 pounds, whereas in 1915, the exports had risen to 256,000,000 pounds; that is to say, the demand for zinc from the United States, where the zinc of this continent has been refined, was increased sixty-fold in a period of one year. The price rose from about 8 cents a pound, which was, I think, the price prevailing before the war broke out, to 40 cents a pound in 1915. It was brought to our attention last summer by the Shell Committee that the Canadian manufacturers of brass cartridge cases were unable to obtain pure zinc for their purposes. At that time no zinc was being refined in Canada, with the exception of that being produced by a small experimental electrolytic plant at Trail. The output of that plant was about one thousand pounds, or half a ton a day. As the result of the shortage in zinc, and of the inability of our manufacturers to obtain the necessary supplies for the manufacture of brass cartridge cases, there was a great delay in their output and the matter became quite serious. We took it up with the view of seeing whether any action on our part would prove an incentive to the zinc producers of Canada, the Consolidated Mining and Smelting Co. at Trail, and the Weedon Mining Co. of Quebec, and

others, to establish plants to provide zinc in Canada at reasonable prices for the purposes of the Shell Committee. After several conferences the Government determined upon this legislation, and, accordingly, a promise was given to the zinc producers in Canada. As the result of that promise, the Shell Committee was enabled to make a contract with the Consolidated Mining and Smelting Co. of Trail for 8,000 tons at the price of 15 cents per pound, with an option upon 8,000 additional tons at a price of 12½ cents per pound.

In consideration of the undertaking which the Government gave to introduce this legislation providing for a bounty, the Consolidated Mining and Smelting Co. undertook to put in the necessary plant to produce zinc at the rate of 25 tons per day, beginning not later than five months from the date of the acceptance of their offer by the Shell Committee. In a word, therefore, the result of the promise which was given by the Government to introduce this bounty legislation, is that the Shell Committee, and the manufacturers of brass cartridge cases in Canada, have been enabled to obtain domestically a supply of pure zinc at 15 cents per pound at a time when pure zinc was selling in the United States at 40 cents per pound. I think that the price of pure zinc in the United States to-day is about 30 cents per pound. I do not think that any further explanation is necessary, as the resolution is fairly plain in its terms.

Mr. Devlin: In view of the promise of the bounty, have many manufacturers given the assurance that they will manufacture this smelting zinc?

Sir Thomas White: There were two companies I have mentioned, the Consolidated Mining and Smelting Co. at Trail, and the Weedon Mining Co. in the Province of Quebec. I am not aware at present of any others, but we made the announcement broadcast through the press, and sent a copy to all those engaged in the zinc mining industry in Canada.

Mr. Graham: There will not be much paid under this legislation at present?

Sir Thomas White: I am glad my hon. friend has raised that point. I overlooked mentioning the reason why it was considered necessary that this bounty should be given. It was this: the producers of zinc were unwilling to establish an expensive plant in view of the possibility of the war coming to an end soon. They were quite content with the price which could be obtained during the war, but what they feared was that if the war should come to an end in the early future, the price of zinc would at once drop and an expensive plant would become unprofitable. They were content to establish their plant should the war last as long as the 1st of July, 1917; so that the contingencies which they had in mind have been provided for in the resolution before the Committee.

Mr. Devlin: Did they ask for any advance on their contract?

Sir Thomas White: At the outset—I am speaking now from recollection, but I am certain that I recall accurately—there was a proposal that the Government should make an advance for the purpose of defraying a part of the cost of the plant. That was not regarded favorably, and the bounty resolution took its place as being more satisfactory.

Mr. Sinclair: Is it understood that the output of the mines, or the product of this industry, will be confined to Canada or to the use of the Allies during the war?

Sir Thomas White: The legislation is general in character, but the Shell Committee was, as I stated, able to make a contract for 8,000 tons at 15 cents per pound at a time when the price in the United States was 40 cents per pound, with an option upon a further 8,000 tons at a price of 12½ cents per pound. I was assured by the Shell Committee at the time that the arrangement which they had made was perfectly satisfactory to them, and, so far as I have been able to learn, there is now no danger of the manufacturers of brass cart-ridge cases being short of pure zinc.

Sir Wilfrid Laurier: We had legislation of this nature some years ago. Has it expired?

Sir Thomas White: My right hon. friend is probably thinking of lead.

Sir Wilfrid Laurier: Did that legislation not apply to zinc also?

Sir Thomas White: My right hon. friend may be right, as his memory is usually good, but I do not recall that it applied to zinc. There is legislation relating to lead very similar in character to this; that is to say, it provides for a bounty on a sliding scale.

Mr. Graham: As I understand it, this merely guarantees to the producer a certain price to a certain date; that is, that the zinc will not go below a certain price. If it remains at a price of over 8 cents per pound, the producer will get no bounty, but should the war cease before 1917, and the price recede to 6 or 7 cents per pound, he would get a bounty.

Sir Thomas White: Yes.

SILVER.

"The American Metal Market" quotes Zimmerman & Forshay on the position of silver as follows:

"Never in the memory of the oldest handlers of silver have conditions governing the supply and demand been so unique. The increase in demand is not only for actual use, but for speculative purposes, the rapid rise having tempted investors in all parts of the United States to take a flyer in the white metal and to hold on until within a small fraction of the top, having protected themselves by 'stop' orders by which they follow quotations.

"The immensely increased circulation of money to the wage earners in the States, which has now endured for over a year and a half, leaves a surplus after living expenses, to be invested in a few luxuries, and has resulted in a very healthy demand for silverware and silver novelties, in anticipation of the continuance of which the silversmiths are buying very largely to protect their fall business.

"It is becoming more apparent from day to day that at the conclusion of the European trouble there must be some adjustment of finances, even probably to the extent of the creation of a greater limit at which silver will be taken as a legal tender, as gold has practically disappeared from circulation, and the immense debt accruing through the war being out of all proportion to any gold reserves, a new medium must necessarily be created with but one recourse—silver.

"The issues of fractional currencies from the various countries recall the old shin plaster of our own war of 1861. These issues are probably silver currency and must eventually be retired from circulation as they are emergency issues only.

"The transportation facilities from the States are now down to a minimum, with only an occasional American line boat in the White Star service.

"The combined transportation of silver in one week is hardly sufficient to fill one Mint order from any of the European countries. Russia is the only exception to all metals coming from our Port, as silver for their account is shipped via San Francisco to the Japan Mints who are at present time coining for the Russian Government.

"The entire known stock in London is less than 5,000,000 ounces.

"An embargo recently enacted by the government of Mexico prohibits the exportation of either gold or silver, and, if rigidly enforced, will very materially reduce the floating supply as even with the closing down of several mines, a fair estimate of 30,000,000 oz. per annum would not be much out of the way.

"All the copper, lead and zinc mining companies in the States are driving to their capacity to take advantage of the prevailing high prices and in consequence delivering to the market a much increased supply of silver which only figures as a by-product with them, but helps somewhat to offset the shrinkage from Mexico.

"There has been no appreciable let up in the shipments from the Cobalt section as the worrisome tax imposed has been figured down to minimum and will not be a very heavy burden to any prosperous producing mine.

"While we have enjoyed a most persistent and rapid rise in silver since the Sherman law, there is no reason at the present time to believe, barring a few slight reactions through the flowing over of some large speculative holdings, that we will see anything but better prices, and even should the war suddenly cease and silver take a quick slump, as was the case upon the announcement of the armistice between Russia and Japan, it will soon come into its own again and enjoy its position with the raise of the metals that have had material and substantial advances."

LA BELLE, KIRKLAND.

Mr. Frank Loring, president and general manager of the La Belle Kirkland Lake mines at Goodfish lake, went north yesterday after a trip to Baltimore. Mr. Loring states that the shaft has now reached a depth of 310 feet. A new station has been cut and the vein drifted on for about 30 feet. From this drift some remarkable specimen ore has been taken and the vein is looking good. The footwall of the vein for the greater part of the way sloped at an angle of about 60 degrees, but at the 300 ft. level this has straightened up now to about 70 degrees. The hoisting plant has a capacity of 1,000 ft.—Cobalt Nugget.

CHAMBERS-FERLAND.

Cobalt, May 6.—Twenty-six feet of drifting has been done on the new vein found at the 425 ft. level of the Chambers-Ferland about ten days ago, and bonanza ore shows for the entire distance. Attention is being centered principally on this new find. The vein is about 4 in. in width and the lowest assay obtained was 1,400 oz. of silver to the ton, while assays as high as 6,000 oz. to the ton have been taken. The average of the vein will be somewhere between 2,500 and 3,000 oz. to the ton, it is estimated.

Nothing further has been done on the new vein found at the 450 ft. level on Monday last, but this will be followed later. The new vein is more regular now than at the point where cut and shows as though it might have considerable continuity.—Cobalt Nugget.

METALLURGICAL IMPROVEMENTS IN BRITISH COLUMBIA

By E. Jacobs.

Unmistakable evidence of the progress metalliferous mining is making in British Columbia is found in the installation of new metallurgical plants, the enlargement and improvement of others that have been in use for years, and the making of arrangements for the operation of still others that had long been idle. Generally, it may be said that there are few operating reduction works that have not been improved in recent years by the adoption of newer methods and the addition of modern metal-saving appliances which have considerably increased their effectiveness and made them better adapted for the metallurgical work they had been erected and equipped for doing.

In particular, three mining and metallurgical companies have made important additions and improvements, namely, the Consolidated Mining and Smelting Company of Canada, at Trail, West Kootenay; the Britannia Mining and Smelting Company, at Britannia Beach, Vancouver mining division; and the Granby Consolidated Mining, Smelting and Power Company, at Anyox, Skeena mining division.

The Consolidated Mining and Smelting Co., which has long been operating large lead and copper-smelting and electro lead-refining works at Trail, during recent months added an electrolytic zinc-refinery, concerning which the Trail News said on April 7th: "The Consolidated Co.'s new electrolytic zinc-refinery at Trail has been operated steadily with one unit for some weeks, while the entire plant is being adjusted and tuned up for steady production. Altogether there are nine units in the present installation, with a capacity of about 50 tons of spelter daily—each unit capable of producing five or six tons." Other reports are to the effect that the Consolidated Co. is preparing to establish at Trail a sulphuric acid-manufacturing plant, to be followed shortly by an electrolytic copper-refinery. In this connection it is recalled that there was included in the report of the directors submitted at the annual meeting of shareholders in the Consolidated Co. held on December 28th last, the following statement: "Since the last report important additions have been authorized at the smelter, to take care of an increased tonnage of ore and also to allow of the production of zinc on a commercial scale and to provide a copper-refinery. These additions and extensions are well under way at the present time and some of the equipment is already in operation. Contracts have recently been entered into with the Shell Committee for the supply of a considerable tonnage of zinc and refined copper. The manufacture of zinc is a new departure for the company, but with the large quantity of zinc ores available in the company's mines, it will develop into an important feature of its operations. Up to the present the copper matte coming from the smelter has been refined in the United States, but the copper refinery at Trail when in operation will enable the company to refine copper in Canada." The general manager's report, also submitted to the annual meeting, included mention of the extended and advantageous use at the smelting works of the Cottrell plant for the recovery of fume and flue dust, the erection and equipment of a new lead-sampling mill, the construction of a third lead-furnace, additions and improvements to the electrolytic lead-refinery, the installation of copper converters and necessary accompanying plant, and other additions and improvements.

While no recent report of the manager of the Britannia Mining and Smelting Co. is available at the time of writing, it is known that much progress has been made in the direction of enlarging the milling and concentrating capacity of the company's metallurgical works at Britannia Beach, Howe sound. About a year ago the general manager reported: "The old mill has been brought to an increased state of efficiency through the installation of various improvements. The new mill, which is being erected in two 500-ton units. . . will be up to date in every respect and the effort is to make it the simplest, most economical and efficient mill possible for the treatment of copper sulphide ores." The Provincial Mineralogist wrote, in the "Preliminary Review, 1915," as follows: "The Britannia Co.'s old 800-ton mill was in operation throughout the year, and the first 1,000-ton unit of what will eventually be a 4,000-ton mill was completed and commenced operations late in the year. This mill is situated on the side-hill, in such a way as to allow of a complete gravity system of handling the ore in its passage from crude ore at the top to concentrates at the bottom. Throughout the mill the construction work is of the highest order and the design is in every way up-to-date. The old mill has provided the means of testing the ore thoroughly, so that the most efficient machinery could be installed in the new mill. The process used is a water-concentration by means of jigs and tables, followed by a treatment of the tailing by the oil-flotation system of the Minerals Separation Company. The fine crushing is done in tube mills, in which harder lumps of the ore are used as pebbles, thus saving the cost of imported pebbles and increasing the output. Power is obtained by the hydro-electric development of several water powers, there being in all eight dams, either constructed or under construction. The most important of these is the Utopia dam at the head of Britannia creek. There, 2,500 horse power is now developed, and it will be increased to 5,000 horse power. Steam power is used as an auxiliary, there being three 500-h.p. Babcock & Wilcox high pressure boilers, with necessary engines; oil fuel is used in the boilers."

While it is full two years since actual smelting was commenced by the Granby Consolidated Co. at its works at Anyox, Observatory inlet, the first blast furnace having been blown in about the middle of March, 1914, there have since been made important additions and improvements. The plant as at first provided for included three rectangular water-jacketed blast furnaces, each 50 inches wide by 360 inches long, and three basic converters, Great Falls type, each 12 feet in diameter. In the company's last annual report information was given showing that "the first year's operation has gone far in securing a condition of smooth running with lengthening campaigns for the furnaces and, as a consequence, a greater quantity of ore treated per month with constantly lowering unit costs." The general manager stated in his report that "The plant—originally designed to treat 2,000 tons of Hidden Creek ore a day—has been well arranged and constructed for the economical treatment of these ores. The changes that have been made are minor ones, which actual operation has demonstrated would simplify methods and give greater efficiency. The addition of the fourth furnace and appliances for taking care of flue-dust,

will undoubtedly raise the normal output of the plant as at first designed, fully 50 per cent." The company's superintendent of smelteries reported: "A number of improvements have been made in order to lower costs The No. 4 blast furnace and the agglomerating plant are now under construction." Since then this additional plant has been completed and put in operation. Assuming that the general manager's estimate of consequent increased capacity is being realized, a total treatment of 3,000 tons of ore a day has been provided for. With ore of a similar average copper content to that smelted last year, this would give an output, operating at full capacity throughout the year, of between 35,000,000 and 40,000,000 lbs. of copper a year. The actual output, of course, will be determined by the time operated and the average grade of the ore smelted. There is, though, good reason to expect an increase of not less than 50 per cent. over last year's production of copper.

While generally a good standard of efficiency has been maintained at the various concentrating plants in Slocan and Ainsworth mining divisions, at which silver-lead-zinc ores have been concentrated, there have not been changes on anything like so extensive a scale as at the several copper-smelting plants above-mentioned. Yet in degree the progress made has been important in two or three instances. At the mill, on Four-mile creek, near Silverton, the Minerals Separation flotation process has been in use for some time with good results, the percentage of saving of the silver-zinc contents of the comparatively high-grade ore occurring in the company's Hewitt-Lorna Doone mine having been increased appreciably over that obtained by the ordinary water-concentration process. Both this plant and that of the Standard Silver-Lead Mining Co. at Silverton were put in during quite recent years. At the latter, experiments in zinc-saving are being continued, but there has not yet been made any important advance commercially beyond the customary water-concentration method. The new concentrator at the Galena Farm mine, also near Silverton, is reported to have done excellent work on lead-zinc ore during the five or six months it has been operating.

The zinc-concentrating mill at Rosebery, erected and equipped half a dozen or more years ago, which had been unused during the greater part of that period, was overhauled early last autumn and, after Wilfley tables had been substituted for Luhrig vanners, was put in operation in October. Since then it has been running on Lucky Jim zinc ore. The Ruth Mines, Ltd., resumed concentration of silver-lead ore at Sandon, after a long period of inactivity, and the Slocan Star Mines, Ltd., also operated its mill after thorough overhaul and preparation for making two products—silver-lead and silver-zinc concentrate. It has been announced lately that a tube-mill is to be put in by this company, and that flotation is also to be added soon. There was little change at other concentrators in Slocan and Ainsworth mining divisions.

At gold-saving mills there were not many changes. Additions to the Relief company's plant, in Erie camp, Nelson division, included a duplex Dorr classifier, a 4 by 20 ft. tube mill, cyanide-plant, and a steam boiler and engine. New plant and machinery at the Hedley Gold Mining Co.'s 40-stamp mill were a Traylor 24 by 36 in. crusher; a second 5 by 22 ft. tube mill, with Montano-Tonopah lining; a Dorr classifier, which works with the tube mill in continuous system; four more large cyanide tanks; a third Oliver continuous

filter, and other plant. This company's new hydro-electric power system, of considerable capacity, has been found fully equal to expectations.

SILVER MINERS' WAGES INCREASED.

Cobalt, May 6.—After considerable consideration on the part of the different mine managements extending over a period of about two weeks, the majority of the companies have decided to raise the rate for all men working underground 25 cents per shift, based on what has heretofore been the standard scale.

In addition to this it has been decided to grant a bonus of 25 cents per shift to all employees both surface and underground, whenever the price per oz. of silver for the preceding calendar month has averaged seventy cents or more.

The average for the preceding month is taken because it would be impossible to have the current average price on time to effect pay rolls in process of being made up, and this is especially applicable in view of the semi-monthly pay roll which will shortly come into effect.

The changes above enumerated go into effect as at May 1st inst.

The above action on the part of the different companies, entirely on their own initiative, must meet with the hearty approval of all those interested in or dependent upon the mining industry in this camp, and must be further accepted as a generous act that will reflect to the advantage not only of the men directly affected, but to the merchants and citizens of the community.—Cobalt Nugget.

HUDSON BAY ZINC CO.

Boston, April 27.—With a period of 18 months in which to carry on development work in order to determine if actual purchase would be profitable, Hayden, Stone & Co. have secured an option on the Hudson Bay Zinc Co. property located eight miles from Salmo, B.C., and but a few miles north of the United States boundary. The Great Northern Railroad serves the territory, while the new zinc plant of the Consolidated Mining & Smelting Co. is a comparatively short distance away. During the past few months there has been shipped from development work alone about 1,000 tons monthly of carbonate ores to the Edgar smelter and one other plant in the United States, the Consolidated plant not being equipped as yet to handle this class of material. The most important piece of development work now under way consists of driving a tunnel some 1,200 feet before ore can be reached. In the so-called second tunnel it is expected that sulphide ores will be found. The ore carries lead values in varying amounts, but no silver. Sufficient work has not yet been accomplished to determine the possibilities of the property.

FIRE IN SOUTH PORCUPINE.

South Porcupine, Ont., May 6.—Fire starting in the Club Cafe about 10 o'clock this morning spread rapidly under a stiff breeze along the street, and caused several thousand dollars damage before it was finally gotten under control by 11.30 o'clock.

The buildings destroyed are: The Homer L. Gibson block; Chinese restaurant; Chinese laundry; Club Cafe and the George Fairburn building.

The Bank of Commerce building and Sky Brothers' store were both slightly damaged.

ANNUAL REPORT BEAVER CONSOLIDATED MINES, LTD.

The directors of Beaver Consolidated Mines, Ltd., in their report for the year ending February 29th, 1916, say:

Aggressive development was the policy for the past year and we are pleased to state that more footage was made than in any previous year. The mine is approaching a most interesting period. Upon the discovery of silver in Cobalt, the Provincial Geologist of Ontario, Dr. Willet G. Miller, made an exhaustive study of geological conditions in Coleman township, and in 1904 proved beyond question the existence of a diabase sill which intrudes both the Keewatin and Huronian formations. The rock formation of the surface of the Beaver property is Keewatin, and to the northwest of us, the diabase sill has come through the Keewatin to the surface. The Beaver shaft was sunk in Keewatin formation, and at a depth of about 500 feet, encountered the contact between the Keewatin and diabase. Along this contact, both above and below, we have obtained our richest values. Diamond drilling (the expense of which has been shared equally by the Beaver and Temiskaming companies) has proven the thickness of the diabase sill to be a little over 1,100 feet, consequently the lower contact at the Beaver property would be between 1,600 and 1,700 feet from the surface. Several companies—the Kerr Lake, Lawson, Drummond, O'Brien and others—have mined along the lower contact, winning millions of ounces of silver. However, the lower contact has not been penetrated southeast of the Kerr Lake shaft except by the diamond drilling which has been done by the Beaver and Temiskaming. It would seem that the theory of eminent mining engineers, that the silver came up with this diabase flow which formed the sill, and deposited along both the upper and lower contacts, has been proven by the values which have been won by the Beaver and Temiskaming along the upper contact and by the Kerr Lake and other properties along the lower contact, the upper contact of these latter properties having been eroded away.

With the knowledge that the Beaver has two contacts, along the upper of which we have recovered our richest values, together with the knowledge that the lower contact has produced such immense values at these other properties, we have deemed it advisable to explore the lower contact in our property. The main shaft is down to a depth of over 1,400 feet, leaving about 200 feet of sinking to be done before commencing the development of the lower contact.

General conditions for mining have changed somewhat owing to the European war in which Canada is engaged, and our development work is much more expensive on account of the increased cost of materials which are essential for our operation.

Below we give you a synopsis of the development which has been accomplished both in the main shaft and on lateral work on the different levels during the past year:

Drifting.	3,077.5 feet
Crosscutting.	808.5 feet
Raising.	848.5 feet
Sinking.	476.5 feet

Total. 5,211.0 feet

Stoping. 8,480.5 cu. yds.

The main shaft is down to a depth of 1,400 feet. Station cut at the 1,200-foot level.

200-Foot Level.—In the No. 2 stope on the No. 5 vein, we have broken down 204 cubic yards of mill

rock. In the latter part of February, we started a crosscut to pick up our No. 4 vein which has shown values on the 400-foot level.

300-Foot Level.—On our new vein system, we have done 130 feet of drifting and 21 feet of raising. The vein shows strong and encouraging. Three hundred and sixty-seven feet of drifting on No. 1 vein in drifts No. 22 and 23 has been accomplished as well as 213 feet of drifting in drifts Nos. 24, 25 and 26 on No. 4 vein. The veins in Nos. 24 and 25 drift have shown some values and in the back of these two drifts we have a chute of low-grade ore about 165 feet long.

350-Foot Level.—Only a small amount of work was done on this level during the year.

400-Foot Level.—Seven hundred and fifteen feet of drifting, 217.5 feet of crosscutting and 80 feet of raising was accomplished on this level. The veins in Nos. 20 and 24 drifts are very irregular, varying in width and values for some distance and then narrowing down and carrying little or no values. We have also driven a crosscut 100 feet farther to the west, picking up No. 1 vein, on which we have drifted for a distance of 145 feet. This vein is about three inches wide and well mineralized. In other parts of this level, several good bodies of mill rock have been developed.

460-Foot Level.—Five hundred and three feet of drifting, 411 feet of crosscutting and 233 feet of raising, together with 1,859 cubic yards of stoping, has been done on this level. About 60 feet of this drifting was done in high-grade ore and about 58 feet in mill rock. We estimate to have about 100,000 ounces of silver in broken ore on timbers on this level.

530-Foot Level.—Seven hundred and six feet of drifting, 61 feet of crosscutting, 482 feet of raising and 2,560 cubic yards of stoping has been done on this level, encountering some small lenses of high grade ore as well as mill rock. In a sub-level, we have taken out some very good high-grade ore and developed a quantity of mill rock.

600-Foot Level.—Quite a lot of stoping has been done on this level and large quantities of mill rock developed but very little high grade.

700-Foot Level.—Work on this level, during the year, has been intermittent and no further values have been encountered.

800-Foot Level.—Very little work has been done on this level during the year.

900-Foot Level.—A station was cut at this level for working purposes in sinking, but no crosscutting or drifting done.

1200-Foot Level.—A large station has been cut on the east side of the shaft at this point and all preparations made to continue the sinking of the main shaft to the lower contact.

Mill.—The capacity of the mill has been increased and it is now treating from 125 to 150 tons a day. We have a large surface dump which will probably all be milled this year. We estimate to have in broken ore on stulls underground ready for the mill 34,332 tons. During the year we treated 30,093 tons of ore, recovering 474 tons of concentrates which produced 349,900 ounces of silver.

Production.—Production was curtailed last year owing to the low price of silver. Our recovery was 746,310 ounces.

Silver.—Upon the outbreak of the war, the silver market became demoralized and for a period during 1914, there was no official quotation for the metal. It

was not known to what low level the price would drop, nor could there be gleaned any information on this subject. The demand for copper became so keen that every effort was made to stimulate the production of this metal. In a great many instances, silver is associated with copper, and with the increased production of the copper mines, it was thought that silver was accumulating in such immense quantities that the price might be forced even below 46¼c. per ounce. However, there soon developed a demand for silver for coinage purposes by the countries at war, particularly England, France and Russia, and it was at this time that the true stocks of silver became known. They were found to be much below normal and from that time, the price of the metal gradually increased until it reached the price of 56⅝c. per ounce on February 29th, 1916. India and China, the largest silver consuming countries in the world, are reported to be much short of their requirements. This, together with the demand made by the warring countries for coinage purposes, has had a very strong, stimulating effect upon the price of the product. Mexico, the largest silver producing country in the world, has been practically at a standstill for some time past, as far as silver production is concerned, and it would hardly seem that the two great silver producing camps, Cobalt and Tonopah, would be able to furnish the requirements of the several countries. The recent decree published by the Sultan, making the Indian rupee legal tender in Egypt, is another very important factor. It would seem that the present price of silver would be maintained for some time, while some predict that it will sell as high as 70c. per ounce.

While we have a large amount of silver both in ore and in bullion in storage, it has been necessary to sell at lesser prices, from time to time, a part of our product in order to meet current expenses.

The Beaver Consolidated owns sixty acres outright, and three-quarters of the stock in the Beaver Auxiliary Mines Co., the holdings of which are one hundred and twenty acres.

Capital Expenditure and Dividends.

We have invested on Capital Account, \$11,646.42; we have paid two dividends of \$60,000.00 each, and exclusive of ore in dump and in the mine, we have ore on hand, bullion in store and due from smelters, aggregating an estimated value of \$170,277.65, all of which appears in the financial statement.

Inspection.

The United States Government has recently issued through the Department of the Interior, Bureau of Mines, Bulletin 75, wherein it speaks at length on page 247 of the Beaver System of Inspection, and says in part as follows:

"The establishment of company inspection systems has become so common as to make it quite impossible to describe them all. The systems of three different companies have been selected as typical of three phases of the mining industry and as representing, each in its own class, probably the highest development of systematic inspection. The Beaver Consolidated Mines, Limited, operates in Cobalt, Ontario, Canada, a property that is typical of the small mine; the Treadwell group, on Douglas Island, Alaska, although nominally owned by three companies, is operated really as one property, and is an excellent representative of the single large mine; the Cleveland-Cliffs Iron Co. operates a number of detached and rather widely separated mines in the Marquette district of Michigan, and is taken as the

example of the large company with extensive interests."

"In respect to the thoroughness and success of its safety efforts, the Beaver Consolidated Mines, Limited, is perhaps the most interesting on the continent."

Employees' Social Welfare.

Both the Beaver and Temiskaming mines, being situated about five miles from the town of Cobalt, early in 1915 the joint management of these properties advised the organization of a social club. The companies joined in buying a moving-picture machine; a building was fitted up; the machine installed, and once a week, films are received from Toronto and an entertaining and instructive picture show is given for the benefit of the employees and their families. Only employees of the two companies are eligible for membership. The members pay 50c. a month for the expense incurred. They have music and other entertainments as well as the picture shows, and all of this at a cost of 12½c. per week per member or family. This has been greatly appreciated by the employees and their families and has made conditions much better both from a social and educational standpoint.

Mining Account, Beaver Consolidated Mines, Ltd.

For Financial Period ending 29th February, 1916.
Earnings—

Ore sales actual.....	\$196,357.84
Estimated value of ore on hand	42,424.00
Estimated value of bullion in store.....	104,323.00
	\$343,104.84
Bank interest earned and accrued.....	1,984.36
Rents collected	2,115.96
Boarding house	2,037.52
Dividends—Temiskaming stock	1,398.00
Stores account	484.14
	\$351,124.82

Charges—Operating—

Mining labor	\$83,336.30
Mining supplies	35,184.52
Assaying.....	900.27
Horse expense and teaming.....	2,447.99
Insurance.....	1,685.88
Taxes.....	367.58
Mine general expense	13,835.82
Prospecting.....	275.81
Bullion expense.....	529.92
Mine shipment exp'se	6,399.94
Mill operation.....	42,701.51
Erie operation.....	117.32
Mill shipment exp'se	12,006.17
Workmen's compensation	3,047.16
	\$202,836.19

Administrative—

Head office salaries.....	\$12,101.47
Directors' fees	2,865.00
Directors' travelling expenses.....	699.82
Travelling expenses.....	866.42
Stationery & printing	279.16
Legal expense	145.00
Head office rent	600.37
Postage.....	457.05
Telegrams and telephone service.....	155.04

Audit.	250.00	
Head office expense.	510.93	
Periodicals.	9.25	
Stock transfer exp'se	394.45	
Subscriptions.	25.00	
	<u>\$19,358.96</u>	
		222,195.15
Balance transferred to Profit & Loss Acct.		\$128,929.67
Profit and Loss Account, 29th February, 1916.		
Credits—		
Balance at credit, Feb. 28th, 1915.	\$480,981.34	
Transferred from Mining Account, 29th February, 1916		128,929.67
		<u>\$609,911.01</u>
Debits—		
Dividend No. 9 at 3 per cent. \$60,000.00		
Dividend No. 10 at 3 per cent. 60,000.00		
		<u>\$120,000.00</u>
Depreciation provided for		
29th February, 1916—		
Buildings, plant and equipment.	\$7,895.76	
Development.	3,917.74	
Furniture and furnishings.	359.94	
Incorporation and organization.	96.82	
Preliminary and administrative	688.66	
	<u>\$ 12,958.92</u>	
		<u>\$132,958.92</u>
Renewals to buildings and plant.	526.94	
		<u>\$133,485.86</u>
Balance at credit.		\$476,425.15

RAMBLER-CARIBOO MINES, LTD.

Information concerning the Rambler-Cariboo Mines, Ltd., which for many years has been operating a silver-lead-zinc mine and concentrating plant in Slocan district of British Columbia, was published last month by Mining Truth, of Spokane, Washington, U.S.A.:

At a meeting of the Rambler-Cariboo Mining Co. directors held in Spokane on April 1, a dividend of one cent a share, or \$17,500, payable April 15, was declared. This is the first declaration since December 15, 1915, but it is believed that regularly monthly disbursements will be made for an indefinite period. The coming distribution will increase the grand total to \$437,500, the company having paid 22 cents a share in as many consecutive instalments prior to suspending dividend disbursements in 1903, and two amounts were paid in 1915.

The company has in hand a cash surplus of \$40,000, together with approximately 1,000 tons of zinc concentrates averaging about 37 per cent. zinc and 25 oz. silver per ton. Eight car loads of lead ore and concentrates are now at smelters or in transit, so that the company is in excellent financial shape. Orders have been given to the manager, Mr. W. A. Cameron, to push production to the limit as soon as sufficient water shall be available for full milling operations, and it is believed that soon after April 1 ore will be coming out

in larger quantity than at any previous time in the company's history.

It is believed that 150 tons of lead concentrate can be produced monthly, averaging about \$70 a ton. In addition, more than 200 tons of zinc concentrate will be made, while two or three car loads of crude ore, worth about \$3,000 a car, will also be available.

The company has closed a contract with the Kusa Spelter Co. of Dewar, Okla., for its accumulated zinc ore. The basis of sale is \$44 for a 35 per cent. zinc product containing 25 oz. silver, not more than 10 per cent. iron and one per cent. lime. The unit variation is \$2 up or down, while for each oz. of silver above or below 25, a bonus or penalty of 40 cents is provided. Allowing for freight rate of about \$10 and ad valorem duty on zinc content, it is believed the contract will net the company more than \$30 per ton.

Another report, under date April 9, also published in Spokane, attributed to the manager statements to the effect that new discoveries had been made of ore on the seventh and twelfth levels of the mine respectively, this ore having a higher zinc content than that being mined on other levels, though the silver value was similar. Mr. Cameron was reported to have said further:

"We have been producing about 150 tons each of lead and zinc concentrates and 30 tons of crude lead ore monthly for some time. The crude ore runs from 148 to 165 oz. of silver to the ton, and 50 to 58 per cent. lead, while the lead concentrate averages from 70 to 100 oz. silver and 32 to 40 per cent. lead, and the zinc concentrate runs 35 to 37 per cent. zinc, and about 25 oz. silver to the ton.

"During the winter we have been working but 40 men, but we contemplate increasing the force to not less than 50 as soon as the melting snows shall provide more water for power, and our production will thereafter be increased about 20 per cent. The company is in excellent position financially, and we have about 1,000 tons of zinc concentrate stored and ready for shipment as soon as a satisfactory contract shall be secured. Representatives of the larger zinc smelting companies now are negotiating with us for our accumulated zinc product and, too, for the future output."

The scarcity of shipping on the northern Pacific coast is seriously affecting the coal-bunkering business of Vancouver island, British Columbia. Steamers now are too much in demand to allow of time being taken for them to go from Seattle, on Puget sound, to Union bay, Vancouver island, for bunkers, so the Canadian Collieries (Dunsmuir), Limited, is sending coal to the ships and filling their bunkers while they are loading freight-paying cargo. A British tramp steamer is a rare visitor to British Columbia ports these days. Notwithstanding that fact the coal mines in Nanaimo and Extension districts are being worked full time, and conditions are improving for the Comox district mines.

The S. S. Redondo, which left Skagway, Alaska, for Puget Sound ports, Washington, about the middle of April, had included in her cargo 760 tons of copper ore from the Yukon Copper, Grafton, and Arctic Chief copper mines near Whitehorse, Yukon. The ore, no doubt, was consigned to the copper smelting works, near Tacoma, Washington.

The custom stamp-mill at Chena, Fairbanks district, Alaska, is treating tungsten ore.

PERSONAL AND GENERAL

Mr. T. W. Gibson and Dr. W. G. Miller are expected to reach Toronto shortly from England.

Mr. T. C. Denis, Superintendent of Mines of Quebec, is in France, having been called to the colors.

Mr. C. V. Corless, manager of the Mond Nickel Co., is in England.

Mr. Geo. Randolph has been appointed manager of the Adanac mine, Cobalt.

Mr. H. Foster Bain, editor of the Mining Magazine, London, is visiting mines in South Africa.

Mr. Robert Bryce is in Toronto.

Mr. A. P. Ashmore is in charge of operations at the Calumet and Montana mine, Cobalt.

Mr. G. C. Bateman is in Toronto.

Mr. C. A. Foster is in Toronto.

Mr. A. M. Bilsky is in Toronto at the King Edward Hotel.

Mr. D. E. Keeley, formerly mine superintendent at Dome Lake mine, has joined the McIntyre staff.

Capt. Jas. Alexander, principal owner of the Engineer gold mine, on Taku arm, Atlin mining division, British Columbia, was stricken with snow blindness while travelling from the mine to Carcross on his way to Skagway and thence southward to Vancouver. During four days he spent at Skagway waiting for a steamer he was unable to see.

Mr. T. M. Daulton, manager of the Placer Gold Mines Co., which operates on Ruby creek, and Mr. A. D. Hughes, for several seasons superintending the mining work of the North Columbia Gold Mining Co., on Pine creek, and of the Spruce Creek Power Co., on Spruce Creek, returned to Atlin about the middle of April to commence the season's placer-mining as soon as practicable.

Mr. Fred Jay last month took men to the Tantalus coal mine, Yukon, to prepare for resuming coal-production. Manager Milton, who was in Seattle, Washington in April, expected to reach the mine by the middle of May and to thereafter commence mining without delay.

Mr. Caspar Phair, who was appointed Provincial Government Agent at Lillooet, British Columbia, on January 7th, 1878, has been superannuated after 38 years of continuous service. Among his multifarious official duties were those of Gold Commissioner for Lillooet district. He has been succeeded by Mr. John Dunlop, of Lillooet.

Mr. Volney D. Williamson, of Spokane, Washington, well known in northwestern lode-mining camps, last month visited the Bell mine, in Ainsworth mining division, British Columbia. He is associated with Mr. A. L. White, of Spokane, and Mr. C. F. Caldwell, of Kaslo, B.C., in a zinc-mining enterprise, to prosecute which the Jackson Basin Zinc Co. has been organized. The intention is to ship about 20 tons of zinc ore a day, and the contract for hauling from Jackson basin to the Kaslo and Slocan railway at Whitewater is to be let without delay. Meanwhile ore is being sent down to the railway for shipment to the United States.

Mr. Joseph Wendle, long engaged in hydraulic gold-mining in Cariboo, B.C., is to have charge of hydraulic mining operations on Slough creek, Cariboo district, during the ensuing placer-mining season. He left Barker-ville for Slough creek last month.

Mr. Wm. Noble, of New York, has been looking over mineral claims near Hope, in Yale district, British Columbia.

Mr. C. P. Dam, manager of the Golden Dream Mining Co., Bridge river, Lillooet district, British Columbia, is awaiting the arrival of plant and machinery, to be taken in as soon as all the difficulties that the winter's very heavy fall of snow brought to the Pacific Great Eastern railway shall have been overcome.

Mr. George Huston, of Wallace, Idaho, who ten or twelve years ago was proprietor and editor of a newspaper published at Sandon, Slocan, has secured under lease and bond the Calumet and Hecla mineral claims, in Slocan City mining division, British Columbia.

Last month Mr. J. P. McFadden, manager of the Surprise silver-lead-zinc mine, situate near Cody, Slocan, left British Columbia to visit Chicago where he would meet Mr. H. L. Hollis, consulting engineer to the owners of the mine. Last year approximately \$500,000 worth of ore was shipped from the Enterprise, most of it having to be concentrated at a custom mill. It is reported that the owners of the Surprise are likely to soon put in their own concentrating plant.

Major R. W. Brock, second in command of the Western Universities (196th) Battalion, left Vancouver, B.C., for the prairies to inspect companies of the battalion at Winnipeg, Edmonton and Saskatoon. He has since returned to Vancouver and reported excellent progress in recruiting for this unit, which is composed chiefly of students at the universities of the four Western provinces of the Dominion.

Mr. James Breen, of Spokane, Washington, who eighteen or nineteen years ago built the copper smelter at Northport, Washington, for treating ores from the Le Roi and other Rossland mines, after having been for a year or two associated with those who in 1896 established the Heinze smelter at Trail, B.C., recently visited the Consolidated Mining and Smelting Co.'s entirely transformed and modernized works at Trail, which are a striking testimony to the very considerable advance made by the mining industry of Kootenay district since Mr. Breen was actively engaged in its development.

Capt. Angus W. Davis, of Trail, B.C., for a number of years one of the Consolidated Mining and Smelting Co.'s field engineers, has been promoted to the post of major in the Royal Engineers and given command of the 3rd Canadian Engineers Tunnelling Co. A. Bruce Ritchie, also one of the Consolidated Mining Co.'s engineers, is now a captain in the same company.

Mr. Wakely A. Williams, of Anyox, Observatory inlet, B.C., superintendent of the Granby Consolidated Co.'s smelting works, was at the company's works at Grand Forks during the temporary absence of the local superintendent, Mr. W. B. Bishop, who was on a business visit to the Coast.

Lieut.-Col. Guy H. Kirkpatrick, commanding officer of the 11th C.M.R., with headquarters in Victoria, B.C., who is now actively engaged in a recruiting campaign in British Columbia, was formerly associated as a mining engineer with the Messrs. Leckie, now Brigadier-General R. G. Edwards Leckie and Lieut.-Col. J. E. Leckie, both on active service in Europe. The headquarters of these mining engineers was at Vancouver, B.C., until war conditions and an irresistible spirit of patriotism led to an abandonment of civil life and an entire surrender of their services to their country by all three members of the group.

Last month employees at Nos. 5 and 6 mines, Comox colliery of the Canadian Collieries (Dunsmuir), Limited, near Cumberland, Vancouver island, B.C., and other district residents entertained at a valedictory dinner Mr. John H. McMillan, who for about five years had been manager of the two mines mentioned, and who lately resigned on being appointed a district inspector of mines for the British Columbia Department of Mines. Late in April, Mr. McMillan left Victoria for Prince Rupert, at which town he will have his official headquarters.

Capt. Richard Halse Ley, of the 88th Victoria Fusiliers, who on April 25th was married at Christ Church Cathedral, Victoria, B.C., to Miss Theresa Mesher, also of that city, was for some time practising at Nelson, B.C., as a custom assayer, holding a Certificate of Competency and Licence under the British Columbia Bureau of Mines Act Amendment Act, 1899. Mr. Ley had the distinction of being an assayer who was not carried away by the local craze relative to the alleged occurrence of platinum in certain dikes near Nelson, and his failure to discover platinum in samples submitted to him for assay made him unpopular in certain quarters in that city and district. It is significant that not an ounce of platinum has been produced in Nelson mining division during the five years that have since elapsed. After leaving Nelson, Mr. Ley was for some time, until volunteering last year for active service, representative in Victoria and tributary territory of the Giant Powder Co. The marriage of Captain and Mrs. Ley, described at length in the local press as a "fashionable military wedding," was quite an event in Victoria society circles.

Information has been received in Victoria, B.C., that Major E. C. Musgrave, who in the years of its greatest activity and profitable production was superintendent of the Tyee Copper Co.'s gold-copper mine on Mount Sicker, Vancouver island, has been confirmed in his rank and been recommended for honors. After leaving the Tyee mine, Mr. Musgrave was several years in the United States and Mexico managing mines, and later proceeded to England, where he volunteered for active service shortly after the outbreak of the war, and received a captain's commission.

OBITUARY

Charles C. Galloway, elder brother of Mr. John D. Galloway, assistant mineralogist, Victoria, B.C., died of fever at Prestea, Gold Coast, Africa, on April 18th, where he had been for about a year in the service of the Prestea Block A. Co., a British company engaged in gold-mining. The late Mr. Galloway was born in 1884 in Christchurch, New Zealand, whence his father, Mr. C. Scott Galloway, had gone from Scotland some time previously. About 1893 the family left New Zealand for the Old Country, and in 1895 they went thence to British Columbia, going from Vancouver to Greenwood, Boundary district, in 1896. The Galloway brothers attended the public school at Greenwood, and afterward continued their education at the High School in one of the Coast cities. Later both took a mining engineering course at McGill University, Montreal. C. C. Galloway spent four seasons with Geological Survey parties in the field; three seasons in British Columbia and one in Ontario. For a while he was employed at the steel works at Sydney, Nova Scotia, and afterwards

he was with the Anaconda Copper Mining Co. at Anaconda, Montana. Later he was assayer and surveyor at the Coronation gold mine, in Lillooet district, British Columbia. On operations being suspended for a while by the Coronation Co., the late Mr. Galloway returned to Montreal, intending to take a further course in mining engineering preliminary to graduation, but on the recommendation of one of the professors he obtained appointment with the Prestea company and in the spring of 1915 proceeded to England and thence to the Gold Coast where he arrived last June. He had been getting on very well with his work at Prestea, and on intimating his desire to return to England to enlist for service at the front, was strongly urged to remain at his work where he was. This he finally consented to do, but it was not long before fever attacked him and he succumbed. No particulars relative to his illness have yet been received from Africa, only the cabled brief information that he had died of fever on the date above stated.

Leslie C. Hill, who died at Osoyoos, British Columbia, on April 21st, was for a number of years engaged in directing mining operations in various parts of British Columbia and Alberta. When, in 1897 or 1898, he went from Vancouver to Greenwood to develop the Jewel gold mine, near Long lake, Boundary district, that property was controlled by Vancouver men, who were also interested in the Vancouver group, near Silverton, Sloean, and this property too, Mr. Hill developed. Later, he directed the development of the Bend d'Or mine, now included in the Coronation group, situated on Cadwallader creek, Lillooet mining division. As manager and mining engineer for the Hastings (B.C.) Exploration Syndicate, of London, England, he effected a transformation from a mining enterprise somewhat heavily burdened with debt to a productive dividend-paying undertaking. Before retiring from mining engineering to live on his ranch at Osoyoos, to which place he removed from Nelson several years ago, he did a lot of development work on some coal properties in Southwest Alberta, owned by the Head Syndicate, of London. During many years of professional activity he also did much civil engineering—he was an Associate Member of the Institute of Civil Engineers. For some years, too, he was a member of the Canadian Mining Institute. He was a good representative of the typical Old Country professional man, and it was significant that his foremen and superintendents remained in his employ for many years.

On May 1st the death occurred at Victoria, B.C., of Alexander McArthur, who was born in Auchnagat, Aberdeenshire, Scotland, in 1835, and who in 1857 crossed the Atlantic from Scotland to Canada and, after five years' residence in Ottawa, Ontario, in 1862, journeyed to New York and thence via the Isthmus of Panama and San Francisco to Victoria, on his way to the Fraser river and Cariboo gold fields. For about thirty years he was a placer-miner, and then for a while he was blacksmithing at Barkerville, Cariboo. In 1898 he removed to Lillooet, and eight years later to Vancouver, in which city he resided until about seven years ago he made his home in Victoria, where, at the age of 81 years, he died after having lived in British Columbia about 54 years. He made many friends in the Province, some of whom had known him from pioneer days, and now they mourn the loss of one who was always genial and cheery, and whom they respected and loved.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

At the end of April a very comprehensive proposed Workmen's Compensation Act was having the close consideration of the Legislative Assembly of British Columbia, the Provincial Government having brought in a bill dealing with this important question after it had been for fully a year given the careful attention of a Commission specially appointed to conduct investigations and to make recommendations in accordance with their conclusions after having taken into account all the benefits provided by legislation elsewhere. It is significant that, speaking generally, both labor organizations and employers are freely expressing approval of the new measure submitted by the Government, changes suggested being only of details to meet the views of these vitally interested parties.

WEST KOOTENAY.

Ainsworth.—Production of silver-lead ore in this division seems to have fallen off lately, for there was only one small lot received from it at the smeltery at Trail during three weeks ended April 21st, though shipment of lead concentrate from the **Bluebell** mine, Riondel, Kootenay lake, has been continued at the normal rate. It is reported that the higher wages obtainable by miners in the Coeur d'Alene district of northern Idaho, which can be easily reached from West Kootenay via Spokane, Washington, are attracting miners from Ainsworth and Slocan. The big silver-lead and zinc mines of the Coeur d'Alene district are experiencing a time of abnormal prosperity and profit-making, so are increasing ore-production to the greatest extent possible.

Rossland.—The output of ore from **Rossland** mines is being well maintained; in fact, the average daily quantity shipped to Trail in recent weeks has been larger than in the earlier part of the year. For nearly ten weeks ended March 7th the daily average was 901 tons; for 45 days to April 21st, it was 1,030 tons a day.

The **Josie** mine report for the month of February made to the head office of the Le Roi No. 2, Ltd., in London, England, by the company's managers at the mine at Rossland, showed that during February there was shipped to Trail 1,343 tons of ore. The receipts from the smeltery were \$19,591 in payment for 1,281 tons of ore shipped, and \$333 in payment for 42 tons of concentrate shipped. Sundry receipts were \$372. Total receipts for month, \$20,296. Estimated working costs for corresponding period were \$4,200 for ore production. Other expenditures were \$2,101 on capital account, and \$10,500 for mine development, including diamond drilling. Total expenditures were, therefore, \$16,801.

BOUNDARY.

Last month the **British Columbia Copper Co.** blew in a second blast furnace at its smeltery at Greenwood, which leaves only one furnace still idle.

Shipment of ore from the **Union** mine, in Franklin camp, north of Grand Forks, is to be resumed as soon as the wagon-roads become sufficiently hard to allow of heavy loads being hauled over them. Production in 1915 was estimated at 520 tons, about 400 tons of which was shipped to the Granby Consolidated Co.'s smeltery at Grand Forks and the remainder to the Consolidated Mining and Smelting Co.'s smelting works at Trail. A good idea of the value of the ore is ob-

tainable from a report of the mine superintendent, in which it is shown that the average gold and silver contents of more than 200 tons of ore shipped to the Grand Forks smeltery was 0.85 oz. gold and 45 oz. silver to the ton. The cost of hauling in horse-drawn wagons 25 miles to the railway was \$13.50 a ton; freight by railway to smeltery was \$1.50, and charge for smelting, \$6.75; total freight and treatment costs were, therefore, \$21.75 a ton, which is rather a heavy handicap on mining in Franklin camp.

Included in the mining news published in a recent issue of the Greenwood Ledge were the following Boundary notes: Work is to be resumed on the Big Copper, in Copper camp, five miles west of Greenwood. Laurier and Loon Lake mines, Washington, are shipping ore to the Greenwood smeltery. There are 90 men working at the British Columbia Copper Co.'s smeltery at Greenwood and 125 men at its Mother Lode mine, situated three miles from the town. The Pathfinder, on the north fork of Kettle river, is shipping ore from the dump to the Granby Consolidated Co.'s smeltery at Grand Forks. During May about 200 tons of second-grade ore will be shipped from the Sally mine, on Wallace mountain, near Beaverdell, west fork of Kettle river, to the Granby Co.'s smelting works. There is a good chance for leasers on Wallace mountain, on which there should be at least 100 men working.

SIMILKAMEEN.

The Olalla country, in which there are some promising showings of mineral, is being looked over by mining men from Spokane, Washington.

Work is being continued on the Horn Silver group, situated fifteen miles south of Keremeos. Last year 115 tons of ore from this property, shipped to the Granby Consolidated Co.'s smeltery at Grand Forks, yielded an average 67.6 oz. of silver and 0.2 oz. of gold to the ton. A discovery of native silver on a neighboring mineral claim was reported recently.

It has been announced that a diamond-drill will shortly be in use on the Red Buck mineral claim, Kennedy mountain; this property is under bond to Mr. F. S. Norcross, Jun., superintendent of mines for the British Columbia Copper Co., which has been for several years doing extensive exploratory work on a large group of claims on the neighboring Copper mountain.

From the Hedley Gazette it is learned that Mr. W. N. Burke, who is associated with Mr. E. S. Campbell in the ownership of the Golden Rod mineral claim, in Camp Hedley, recently arrived at Hedley from Spokane, Washington, with three miners, to do development work on the property.

YALE.

Although lode-mining is still unimportant in several of the divisions of Yale district, prospecting, and in some cases development work, are being done in a number of places. New railway construction is expected to be followed by the exploration of a number of mining properties, a few of which are being opened with encouraging results.

In the Hope Country.—The West Yale Review, published at Hope, which is on the Canadian Pacific Transcontinental railway about thirteen miles west of the old town of Yale, famous in the early placer-gold mining days of the Fraser river, lately made the following comment: The only extensive free gold finds in Hope

district are on the creeks of the Coquihalla. These will take care of themselves. In addition to a trail up to the showing, all the owners want is the means of transportation that will be afforded by the operation of the Kettle Valley railway trains, a matter of only a short time. But the Skagit valley is in a different position. Its wealth is in copper. . . . There are several properties around the bend of the Skagit river, known as 23-Mile, on which the showings indicate very extensive orebodies and all assays give a high percentage of copper. Thus two of the requirements are met; the other is transportation. Until the mines are developed into shippers it is useless to think of railway transportation; the best that can be hoped for is a wagon-road by which supplies can be taken in and ore for test purposes be brought out at lower cost than now.

Highland Valley.—Mention was made in the Journal of April 15th of the erection of mine buildings and intention to put in a concentrating plant by the Highland Valley Mining and Development Co. This company, of which Mr. Frederic Keffer is president and Mr. Henry Johns, secretary-treasurer (both of whom were for years in charge of operating mines of the British Columbia Copper Co.), has undertaken the development and operation of the Chataway and Sanson groups of mineral claims, distant in an air line approximately 18 miles southeast of Ashcroft, a station on the main line of the Canadian Pacific railway 204 miles east of Vancouver. They are at present reached by a good wagon-road from Ashcroft 25 miles to Chataway ranch and thence by trail three miles to the mine workings. Spatsum, a station of the C.P.R., 14 miles west of Ashcroft, is about eight miles in an air line from the mining property, but to get a suitable grade a wagon-road would have to be about 15 miles long. Last month a deputation from Ashcroft interviewed the Government in Victoria and since then the district road-superintendent has been instructed to report as to the feasibility and approximate cost of making the proposed road, which, as the mines are at an altitude more than 4,000 feet higher than the railway, would have a general down-grade to Spatsum. As for the present only wagon-hauling transportation facilities can be hoped for, the application to the Government to give assistance to this promising mining camp in this way is generally supported in the district, from which the only lode-mine production in 1914 was the shipment of about 100 tons of high-grade copper ore from the Snowstorm and 50 tons from the Glossie group. Sufficient money for further development work, ore production and concentrating mill has already been obtained in Spokane, Washington, so the prospects of success attending the efforts of the Highland Valley Co. are promising. The ore occurring on the Chataway group is composed of quartz, feldspar, mica and copper and iron pyrites, the mica being the predominating mineral. The copper occurs entirely as copper pyrites, and as a rule is distributed through the gangue in quite large crystalline masses, thus constituting an ideal ore for concentrating, especially as the micaceous gangue is soft and easily broken.

LILLOOET.

It is reported that the first carload of ore to be shipped from Lillooet district will consist of ore from a mineral claim on which antimony is the chief valuable metal.

The Lillooet Prospector states that the prospects for ensuing season of the Bridge River part of Lillooet mining division are far brighter than most people have

any idea of. On all the mining properties where there is activity the owners are going about the work in a thorough manner and are developing their claims in a way that will prove that mineral occurs on them. The owners of some of the properties being developed are much pleased with results thus far achieved. The recent provision of railway transportation facilities will be of great assistance toward getting machinery on the ground at much less cost than under former conditions. The future of the Bridge River country looks exceptionally promising, and it is believed that in a short time much more attention will be paid to it by outside capitalists, owing to the good showings of gold occurring in different places in this part of the division.

NEWFOUNDLAND

Iron.—The output of hematite from the Wabana mines owned by the Dominion Iron and Steel Co. and the Nova Scotia Steel Co. at Bell Island has been increasing every week and now exceeds 100,000 tons weekly. During the winter the Dominion Co. maintained its four mines working at full blast, and employed a full staff of men constantly at work. No shipping has yet been done this spring from the mines, but the fullest preparations are now being made to expedite shipping when the steamers arrive. The bulk of the ore from the mines of the Dominion Steel Co. will go as usual to the smelters at Sydney, C.B., but it is likely that more ore than usual will be shipped this season to Great Britain.

Although the plant of the Nova Scotia Steel Co. has not heretofore since the war been working to its fullest extent like that of the Dominion Steel Co., yet the scale of operations at its mines just now is far greater than at this time last year, and doubtless as time goes on orders will be secured to warrant the marvellous deposits of that company once again being worked to the fullest extent.

Bell Island during the past year has grown rapidly, and has risen to be the second town of commercial importance in Newfoundland. It possesses a fine system of municipal government, every effort is being made to lay out the rapidly extending limits of the town conformable with the most up-to-date sanitary advantages. These efforts are meeting with a good measure of success, and for a mining town the floating population is surprisingly small.

Copper.—An impetus, seemingly greater even than the rise in the price of copper itself—is now being given to encourage copper mining in the country in the nature of the new electric smelter erected at St. John's, which is now working at full blast, and with every prospect of being able to handle large quantities of ore from deposits all over the country. Mr. Paul Simpson, the expert who set the plant first in motion declares it to have exceeded all his expectations. The formal opening of the plant was done by His Excellency, the Governor of Newfoundland. The plant at present working is smelting approximately 25,000 pounds of ore per day. Practically all the copper now being produced is being used locally in connection with the making of shells.

All the dumps which have lain around the many copper mines in this country which were once worked and shut down for one reason or another, have been purchased, and cargoes are now being got ready to be sent to the smelter at St. John's.

This has encouraged the numbers of holders of copper prospects to begin on a small scale to work their

holdings, and during the summer dozens of small mines will be worked, and numerous cargoes of ore shipped to be smelted locally. It is extremely likely that two more smelters will be erected during the summer at Notre Dame Bay, both these smelters will be run electrically, as water power is obtainable in abundance at a minimum cost. At this rate it seems as if Newfoundland is likely to revert to her position of twenty years ago, when she ranked as one of the great copper producing countries of the world.

Manganese.—Recently the Mines Department has been receiving numerous enquiries from American and English sources asking if manganese deposits existed in Newfoundland and to what extent. But very little information could be elicited in this regard, as very little authentic information of this nature is in the possession of the Department of Mines and Minerals. Only the scantiest amount of exploration has yet been made in Newfoundland for this mineral. During all last summer, however, one manganese mine was worked and a couple of good cargoes were shipped to Pittsburg. This mine is at Brigus, and it is, we hear, the intention of the owners to resume operations on quite an extensive scale this summer.

Marble.—The marble quarries owned and worked by the Colonial Mineral & Trading Co., Ltd., which are situated at Canada Bay, and which did such excellent work last year, both in quarrying and in shipping, continued operations right through the winter, and will ship this summer on a very large scale, and will supply all the local demand as well as its big shipments abroad. The new plant of the company is calculated to increase the output to a considerable degree. This will be the third year that the quarry has been working continually. The property extends over 1,600 acres and contains millions of tons of pure white marble. The property is owned in England and from there it is now being financed.

Prospecting.—Ever since the snow disappeared early this spring numerous prospecting parties have been out in the interior searching for minerals or examining claims with a view to starting work on the same, and by reason of the fact that until now almost nothing whatever was done to examine the interior of the country for mineral, reports are reaching the Mines Department weekly that numerous finds have been made of copper and other minerals.

His Excellency the Governor, who takes a deep and knowing interest in the development of our mineral resources, has been able to interest the Imperial authorities with the vast possibilities of our mineral development, and the Government analyst has made a most minute report of mineral deposits known to exist in this country, and this will be submitted to the Home authorities, so that very likely much good will accrue from the valuable facts it will contain.

The Newfoundland Shell Co., with a capital of \$100,000, all of which has been subscribed by local parties, has now a factory at St. John's working full blast turning out shells. A very large order is now being filled for the authorities at Ottawa, and in a few days it is expected that the first shipment of shells will be made, direct to England.

The appointment of Mr. D. H. McDougall to be general manager of the Dominion Steel Corporation, caused much gratification to the large number of Mr. McDougall's friends in Newfoundland, where he is well known, having been here at different periods in connection with the Dominion mines at Bell Island.

PORCUPINE, KIRKLAND LAKE AND BOSTON CREEK

The **Hollinger Merger** is, of course, the main subject of conversation in all mining circles of Ontario, but its details have been so thoroughly canvassed and published that it would not be fruitful to set them down further here. The decision of the Hollinger to bring about this merger will insure an extraordinary busy year around Timmins. The company has already started excavations for the extension of the mill. It has been determined to install 100 more stamps, so that the capacity of the plant will be about double. As the present capacity of the plant varies between 28,700 tons and 30,800 tons a month, it is safe to say that the new mill, with its devices for raising tonnage per machine will be able to treat 4,000 tons per day. The more active development of the Acme is assured now. It is understood that primary crushing in the new mill will still be by stamps alone. A new type of stamp is to be used, however. Ten tube mills will be ordered and a device installed in the cyanide tanks which should largely increase their settling area.

Unless some very untoward factor occurs, **Boston Creek** is going to be the most active centre for prospectors this year. The development of the Crown Reserve claims is very encouraging. The Crown Reserve was the third company to do active development work in this section, and all three have met with very promising results, considering the small amount of development undertaken. The Crown Reserve have the McCrea and O'Neil claims and so well are they pleased with their options that they have taken over the four Johnston claims, three of which adjoin their original holding, the remaining one being direct east of the R. A. P. Syndicate.

The little Nissen stamp mill at the Miller Independence Mine is now running and before this is published, the first gold bar should have been shipped from Boston Creek. Some very remarkable ore has recently been shot out of the vein on the surface at the Miller. Underground work is not making very fast progress.

Prospecting has now spread southward from Boston until prospectors find it to their advantage to go in from Krugersdorf. They find that upon many of the claims staked as homesteads in Southern Catherine, the regulations had not been complied with and they were open for staking. Many of these properties have now been staked, and there will certainly be some activity here this spring. It is quite true that a very large proportion of prospectors have gone to the war and thus the exceptional opportunities there are now for developing new mining claims will be much retarded.

LAKE SHORE.

Further development of the Lake Shore find at Kirkland Lake is proving the discovery to be of much importance. The vein was tapped at 300 feet west of the shaft in a cross-cut to the north. At the point where it was cut, it gave \$25 over a width of six feet. It was cut again at 60 feet nearer the shaft and ran about \$12 over five feet. This is a very important development and if it continues to hold out, it is probable that the company will undertake the building of a mill this year.

TOUGH-OAKES.

The settlement of the injunction proceedings in regard to the Tough-Oakes Mining Company has cleared the air to some extent. It is now certain that the con-

trol of the Tough-Oakes will remain in the hands of Mr. C. A. Foster and his associates, until the matter comes to trial, which cannot very well be before the fall. The development of the mine is continuing to be quite satisfactory. The financial statement of the Tough-Oakes for the year ending December 31st, shows that the company made excellent profit. After paying \$132,875, in dividends, there was a debit balance of \$38,607. The net profits for the year amount to no less than \$275,038. Mining cost \$101,897, milling \$83,054, or a total operating expense of \$231,128; leaving the operating profit of \$327,363. Total general and administrative expenses cost \$48,843. The report is confined entirely to financial statement. There is nothing in it of the physical condition of the property, nor are the costs per ton given. z

McINTYRE.

At the time this is being written, the exact importance of developments on the 700 and 1,000 ft. levels of the McIntyre can only be surmised, but it is known that sufficient ore has already been developed to indicate the most valuable addition to ore reserves, since the property was opened up. The cross-cut run from the shaft at the 700-ft. level, opened no less than 62 ft. of ore of a very profitable grade. At 186 ft. a cross-cut had just struck No. 5 vein. On the 1,000-ft. level the long cross-cut between the McIntyre extension and the No. 5 shaft had just entered ore. The ore-body was struck just across the line in McIntyre property and it is remarkable that gold contents were not high until the line was crossed. If development continues as promising as it appears to-day, these recent discoveries are the most significant that have been made on the McIntyre group. Jupiter ore is now being treated in the McIntyre mill. The surface tramway has been completed and 75 tons of Jupiter ore is being hauled over it, to the No. 5 shaft. The McIntyre mill is now treating about 425 tons a day.

GRANBY CONSOLIDATED.

Boston, May 6.—When Granby Consolidated closes its fiscal year on June 30th, there will have been earned during the preceding 12 months in excess of \$20 a share, according to preliminary estimates. April profits approximated \$600,000 before fixed charges as compared with \$470,000 in March. Profits for the first four months of 1916 were close to \$1,800,000.

There was treated at the Hidden Creek smelter during April 76,000 tons of ore which was well up to the highest tonnage yet put through that plant. The four furnaces will be maintained in as continuous operation as possible to insure the maximum of production.

The agglomerator, which has now been in operation for some time, has been giving a good account of itself by adding to the copper output at Anyox. This equipment has demonstrated its ability to extract four pounds of copper from each ton of flue dust at a minimum of cost.

A NOVEL ECONOMICAL AGITATOR.

The following account of what it designates "A Novel Economical Agitator," received by Mining and Engineering World from Mr. Roscoe Wheeler, mill superintendent for the Hedley Gold Mining Co., operating in Camp Hedley, Similkameen, B.C., was published recently by that journal:

"The Devereux patented agitator (a boat's propeller on the end of a vertical shaft), placed in the centre of a small or large tank, flat or conical bottom, ranks

with the best of slime agitators. On account of its ease and readiness of putting a charge in motion, it allows tanks of any size to be used as settlers as well as agitators. It will agitate pulp of almost any specific gravity thoroughly and efficiently with not an excessive horsepower. The simplicity of its few working parts, the small amount of attention needed, the effectiveness of its agitation, and the utilization of tanks of any size, are qualities hard to excel.

"In a tank 30 ft. in diameter with conical bottom of 23 deg. and vertical side 9 ft. above cone, a 4-ft. diameter, 4-bladed, right-hand propeller revolving 90 r.p.m., using 10 h.p., installed 6 ft. above apex of cone, will put in agitation a slime charge of specific gravity 1.25 to 1.50 of 100 to 165 tons dry slimes from rest to agitation in about 20 minutes.

HEDLEY GOLD MINING CO.

The annual report of the Hedley Gold Mining Co. for the year ended December 31st, 1915, shows net profits of \$374,746. Gross recovery from ore milled was \$796,592, from which there was deducted expenditures of \$421,846. The company milled during the year 74,265 tons of ore having an assay value of \$11.65 a ton. Dividends paid in 1915 totaled \$300,000, or 25 per cent. on the issued capital stock. Undivided profits, after payment of dividends, were \$435,070.

Compared with 1914, the average value of the ore mined and milled last year was 85c. a ton higher, so that, while the quantity milled in 1915 was 4,229 tons less, the total value of the gold recovered was within \$750 of that of 1914.

The following figures are totals for the period of six years, 1910-15: Tons of ore milled, 398,653; total receipts (including about \$47,000, interest on money in bank), \$4,360,500; expenditure, \$2,216,111; net profit, \$2,144,389; dividends paid on an issued capital of \$1,200,000, \$1,788,000. Since the close of last year another dividend has been paid, amounting to \$60,000, for the quarter ended March 31st last.

Included in the report for 1915 of the Trade Commissioner for Canada in South Africa, published in the Weekly Bulletin of the Canada Department of Trade and Commerce, No. 638, April 17th, is a table showing the value of the imports of mining machinery into South Africa during five years, 1910-1914, to have been in all \$20,123,000, of which only \$6,900 was from Canada. The proportion from the United Kingdom was \$13,935,000, that of the United States \$3,550,000, and that of Germany \$2,267,000.

SILVER PRICES.

		New York, London,	
		cents.	pence.
April	21.....	65¾	..
"	22.....	65¾	..
"	24.....	65¾	..
"	25.....	67¼	32
"	26.....	67¼	32½
"	27.....	69	33
"	28.....	71¾	34¾
"	29.....	73½	35½
May	1.....	72¾	35
"	2.....	74¾	36
"	3.....	77¼	37¾
"	4.....	76¾	36½
"	6.....	76¾	36½
"	8.....	74½	35½

MARKETS

NEW YORK MARKETS.

May 8, 1916—Connellsville Coke—

Furnace, spot, \$3.75.

Contract (nominal), \$2.50 to \$3.00.

Foundry, prompt, \$3.75.

Contract, \$3.50 to \$3.75.

May 8, 1916—Straits Tin, nominal, 50 cents.

Copper—

Prime Lake, nominal, 29.75 to 30.25 cents.

Electrolytic, nominal, 30.50 to 31.00 cents.

Casting, nominal, 27.75 to 28.25 cents.

Lead, Trust price, 7.50 cents.

Lead, outside, nominal, 7.37½ to 7.50 cents.

Spelter, prompt western shipment, nominal, 17.05 to 17.30 cents.

Antimony—

English brands, nominal.

Chinese and Japanese, 36.00 to 37.00 cents.

American, 36.00 to 37.00 cents.

Aluminum—nominal.

No. 1 Virgin, 98-99 per cent., 59.00 to 61.00 cents.

Pure 98.99 per cent. remelt., 57.00 to 59.00 cents.

No 12 alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, \$110.00.

Platinum, nominal, \$85.00.

Cobalt (metallic), \$1.25.

Silver (official), 74⅞ cents.

Metal Products.—All prices are nominal as follows:

Sheet copper, base, 37.50 cents.

Copper wire, base, 32.50 to 33.50 cents.

High sheet brass, base, 38.00.

Seamless brass tubing, 43.50 to 44.50 cents.

Seamless copper tubing, 43.50 cents.

Brazed brass tubing, 42.50 to 43.50 cents.

Brass wire, 38.00 cents.

Brass rods, 38.00 cents.

Sheet zinc, f.o.b. smelter, 25.50 cents.

TORONTO MARKETS.

May 10—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 9 cents per lb.

Tin, 54 cents per lb.

Antimony, 44 cents per lb.

Copper, casting, 32 cents per lb.

Electrolytic, 31½ cents per lb.

Ingot brass, yellow, 16 cents; red, 21 cents per lb.

May 10—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto, Ont.)

May 8th, 1916.

New York Curb.	Bid.	Ask.
Atlantic Steel	44.62	45.00
Alta. Cons.	12.00	12.50
Butte.	7.00	7.87
Curtiss Aeroplane	40.00	47.00
Chevrolet	207.00	207.50
Cosden Oil	22.75	23.25
Can. Copper	1.62	1.75
Canada Cement	64.50	65.00
Con. Ariz.	1.75	1.87
Emma Copper	47.00	48.00
First National	5.00	5.12
Houston Oil	18.50	20.00

Howe Sound	5.25	5.35
Intercontinental Rubber	15.50	16.00
International Petroleum	11.00	11.25
Manhattan Transit	1.25	1.35
Maxim Munitions	9.00	9.12
Midvale Steel	61.12	61.35
Marconi	3.18	3.35
Mother Lode	32.00	32.50
Poole Engineering	105.00	108.00
Peerless Motor	24.00	25.00
Ray Hercules	4.75	5.00
Steel of Canada	59.62	60.00
Standard Shipbuilding	11.50	12.50
Submarine Boat	35.25	35.75
Salpulp Oil	12.50	13.00
Tonopah Extension	7.06	7.12
Triangle Film	4.25	4.37
U. S. Light	2.87	3.87
White Motors	48.00	49.00

Porcupine Stocks.	Bid.	Ask.
Apex	.05½	.06
Dome Consolidated	.10	.14
Dome Extension	.35	.35½
Dome Lake	.24	.25
Dome Mines	27.37½	27.50
Foley O'Brien	.50	.60
Gold Reef	.01	.02½
Hollinger	29.60	30.00
Homestakes	.46	.55
Jupiter	.24	.24¼
McIntyre	1.22	1.23
Moneta	.12	.14
Porcupine Crown	...	.80
Porcupine Imperial	.03¾	.04
Porcupine Tisdale	.01	.01¾
Porcupine Vipond	.49	.51
Preston East Dome	.04	.04¼
Teck Hughes	.19½	.20
United	.17	.17½
West Dome	.24	.24½

Cobalt Stocks.	Bid.	Ask.
Adanac	.66	.68
Bailey	.08¼	.09
Beaver	.45	.45½
Buffalo	1.00	1.60
Chambers Ferland	.29	.30
Coniagas	5.25	5.60
Crown Reserve	.50	.58
Foster.	.09½	.10½
Gifford	.07	.07½
Gould	.00¾	.00¾
Great Northern	.06½	.06¾
Hargraves	.05¾	.06
Hudson Bay	.32	.38
Kerr Lake	4.75	5.12½
La Rose	.74	.76
McKinley	.65½	.66
Nipissing	7.96	8.00
Ophir	.08¼	.09
Peterson Lake	.31½	.31¾
Right of Way	.06	.06¼
Rochester	...	.04
Seneca Superior	.45	.50
Silver Leaf	.02¾	.03
Temiskaming	.68½	.69
Trethewey	.30	.30½
York Ontario	.01½	.02
Wettlaufer	.10	.11

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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- Building and Ornamental Stones of Canada (Quebec). Vol. III. Report on, by W. A. Parks, Ph.D.
- The Bituminous Sands of Northern Alberta. Report on, by S. C. Ellis, M.E.
- Peat, Lignite and Coal: their value as fuels for the production of gas and power in the by-product, recovery producer. Report on, by B. F. Haanel, B.Sc.
- Annual Report of the Mineral Production of Canada During the Calendar Year 1913, by John McLeish, B.A.
- The Petroleum and Natural Gas Resources of Canada: Vols. I. and II., by F. G. Clapp, M.A., and others.
- The Salt Industry of Canada. Report on, by L. H. Cole, B.Sc.
- Electro-plating with Cobalt. Report on, by H. T. Kalmus, Ph.D.
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- Memoir 56. Geology of Franklin Mining Camp, British Columbia, by C. W. Drysdale.
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- Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
- Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
- Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.
- Memoir 68. A Geological Reconnaissance Between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.
- Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.
- Memoir 73. The Pleistocene and Recent Deposits of the Island of Montreal, by J. Stansfield.
- Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.
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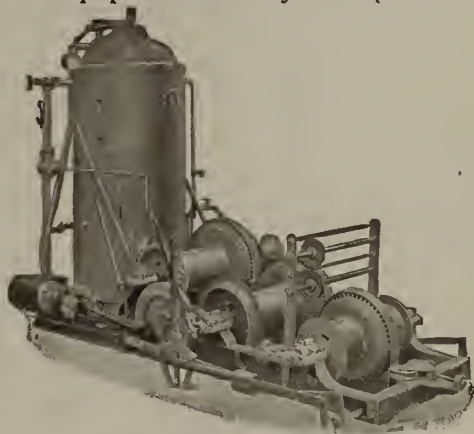
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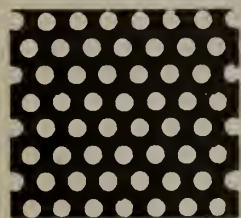
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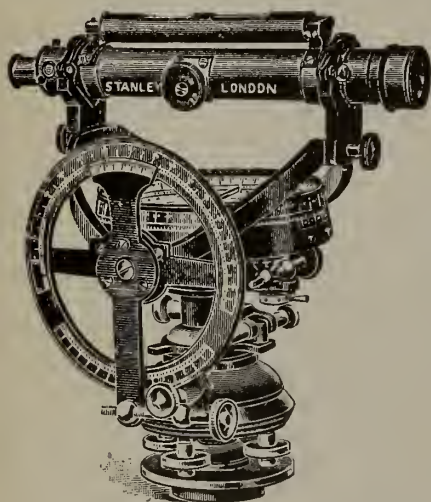
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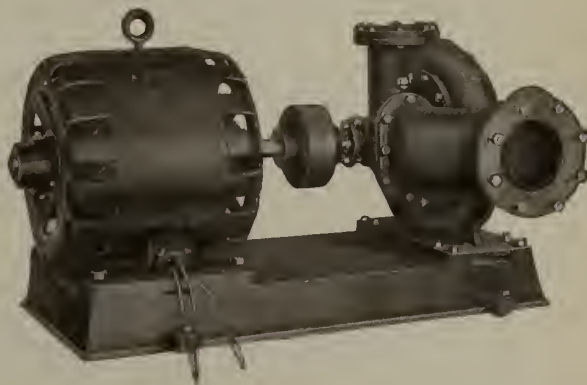
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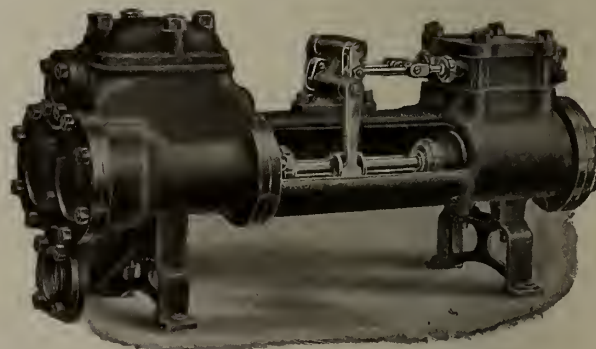
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THE DEVELOPMENT AND UTILIZATION OF OUR NATURAL RESOURCES

Sir R. A. S. Redmayne, in his presidential address to the Institution of Mining and Metallurgy, points out that the war "has emphasized one outstanding fact, viz., that we should and could approximate more closely to the ideal state of being self supporting; in other words, develop to the utmost our natural resources and put them to the most economical use at home."

Speaking in the House of Commons, in January, Mr. Runciman said: "There should be no essential article, either for the arts of peace or for the arts of war, upon which we cannot within the Empire lay our hands."

Such views find ready acceptance in Canada. Before the war the advantages of such a policy for the Dominion were not infrequently urged. The war has widened the view and made more clear the needs of the Empire.

Obviously, if we are to be self-supporting, our first necessity is the development of our natural resources. Fortunately Canada is well endowed. We have agricultural lands, mineral deposits, forests, fisheries and water powers that are contributing great wealth and that are capable of extensive development. Such development should be encouraged. With the war's lessons before us, we may reasonably expect that our Provincial and Federal Governments will see to it that the way is made easy for those who would devote their attention to the production of basic materials.

Fully as important is the utilization of these materials to make in our own country finished articles, instead of exporting for manufacture elsewhere. We should at least manufacture what we need for our own use.

If our metals are to be utilized in Canada we must first refine them here. During the past year considerable advance has been made in this direction, and copper and zinc are now being turned out by Canadian refineries. For some time there has been produced in Canada refined gold, silver and lead, and recently small quantities of cobalt and nickel. Early in 1916 it was stated that a nickel refinery of sufficient capacity to supply the needs of the Empire would soon be established in Canada.

Up to date the erection of the proposed nickel refinery has not been started. There is, however, evidence that the problem of selecting a site is receiving attention. On April 24, for instance, the "Hamilton Spectator" published the following:—"According to information given out yesterday by H. M. Marsh, Industrial Commissioner, the only thing needed in order to secure a branch plant in this city of the Interna-

tional Nickel Refining Co., of New York, is the cancellation of the existing franchise held by the National Gas Company and the establishing of the proposed Semet Solvay Coke plant. Mr. Marsh, accompanied by P. P. Byrnes and John G. Gauld, K.C., of this city, and W. H. Blauvelt, consulting engineer of the Semet Solvay Co., Syracuse, spent three days this week in New York in conference with officials of the International Nickel Refining Company of that city in an effort to persuade the company to establish a branch plant in Hamilton."

An interesting feature of this search for a site for a nickel refinery is the evidence that the refining of nickel in Canada is to be accompanied by additions to our manufacturing industries. Manufacture in Canada of the chemicals to be used in refining metals in Canada is likely to be a result of the agitation for the nickel refinery.

Mr. Hugh Clark, chairman of a Committee on Public Printing, said in the House of Commons on May 18 of Government publications:—"The cost has gone up so tremendously that something has to be done in order to reduce it. The cost has more than quadrupled within the last fifteen or sixteen years. Something has already been done by the present King's Printer, Mr. Tache, and by his assistant, Mr. Cook. They have started out in a proper manner, and if you will look over some of the reports you will see how well the work has been done. Take, for instance, the blue-book of 'Unclaimed Balances,' and the blue-book containing a list of the shareholders of banks, and you will see that by an arrangement of the form and of the type they have put the same material in half the space, the size of the volumes has been greatly decreased and a considerable saving has been effected in that way alone.

"We recommend the creation of a board of editorial management, consisting of men already in the service, who will revise the copy that is sent, and blue-pencil it to some extent, so that the volume will not be so large. If ministers would tell their officers that in the preparation of copy of this sort, brevity would be considered a virtue, it might have a good effect in the meantime. We have recommended that this editorial board should revise all the copy and say whether or not certain copy should be published. There is a great deal of waste material in many of the publications."

We have in these columns called attention to the craze for volume in Government reports; to the printing of useless matter and to the lavish use of paper. We are glad to see that this matter is receiving attention.

MANITOBA MINING BOOM.

Incorporation of four new mining companies in Manitoba, and other evidences of a prospective boom in gold mining there, serve to draw attention to the difficulty which has been experienced in working this business in accordance with Manitoba's "blue sky" incor-

poration law, adopted three years ago. It is only at the last session of the Legislature that this law was amended to give mining companies an opportunity.

The object of this new law was not to prevent people from taking a chance, if they wish to do so. The Provincial Legislature did not want to do this. All that it undertook to do was to see that the people who took the risk got a run for their money.

Under the new law the mining company must go to the public utilities commissioner and get a special certificate. Under this certificate it can sell development stock. The money which is paid for the stock must be handed over to a trust company or trustee. A reasonable proportion may be spent on office expenses. The balance must go into the mine. The commission says that there will be no red tape about the matter, and that if the companies comply with the plain terms of the Act they will get special certificates immediately.

At the present time one of the troubles is to get a trust company to act. These companies, when approached, named terms which were not satisfactory to the mining companies. They wanted, as is alleged, to manage the mining companies, just as they would administer an estate. This was not satisfactory to the mining companies, and no progress could be made. It appears, however, that a trustee has now been found who is satisfactory to the commission, and it is possible that within a few days the sale of stock may begin.—Financial Times.

NEW MINERAL FOUND IN BRITISH COLUMBIA.

Newspapers published in Kootenay district of British Columbia recently printed the following:

After several months of work a new mineral, as yet unnamed, has been discovered, analyzed and classified by E. W. Widdowson, assayer, of Nelson, B.C., in association with Dr. T. L. Walker, professor of mineralogy at Toronto University, and curator of the Royal Ontario Museum of Mineralogy at Toronto.

The new mineral is a white, translucent formation with a yellowish cast. It was first found at the Hudson Bay mine at Salmo, Nelson mining division, last September, when a fair-sized body was struck during development work. At first it was supposed to be a hydrous zinc formation and was exhibited in Nelson as such. This assumption, however, did not satisfy Mr. Widdowson, who secured several samples and devoted much time to analyzing them, sending the results of his work to Professor Walker, together with samples for his own use.

Dr. Walker's analysis is as follows: Zinc oxide, 60.18; phosphoric anhydrid, 26.14; water, 13.32. Mr. Widdowson's results are: Zinc oxide, 60.05; phosphoric anhydrid, 26.74; water, 13.70. The theoretical analysis of the new mineral should, therefore, be: Zinc oxide, 60.32; phosphoric anhydrid, 26.32; water, 13.36.

HOLLINGER.

The general manager's report on Hollinger operations for four weeks ending April 21st, 1916, shows that gross profits for the period amounted to \$158,646.91. Expenditures for plant during the four weeks were \$17,540.

The mill ran 90.7 per cent. of the possible running time, treating 42,673 tons, of which 29,590 tons were Hollinger ore and 13,083 tons were treated for the Aeme Gold Mines, Ltd. Average value of Hollinger ore treated was \$9.09. Milling costs on 29,590 tons were \$0.957 per ton.

SOME OF THE WAR'S LESSONS*

By Sir R. A. S. Redmayne.

To state that we are engaged in the greatest war of all time has become a platitude, but it is the fact that colors all our thoughts and affects all our actions at the present time. We are pouring out life and treasure as never before in the history of the nation; not to secure a material return, but to maintain our hard-won liberties and the rights of small nations to exist. War is the most wasteful of all human activities. The present prosperity that we witness in many industrial undertakings is a purely fictitious prosperity, and, in the true meaning of the phrase, is non-productive of wealth. For these industrial concerns are employed either directly or indirectly, to greater or less extent, in the production of the engines of war—War, the great destructor.

One result of the war is, I think, obvious: it will be followed by a period, longer or shorter, of industrial depression, amounting possibly to something like prostration, but I believe, also, that we have it within our power to remedy matters in a comparatively short period, and to put the nation on a stronger financial and industrial basis than ever before in its history. We must take time by the forelock and make our plans now.

In this connection, reference may be made to the opinion of so great an authority on matters of industry as the President of the Board of Trade, who, in a remarkable and inspiring speech delivered in the House of Commons on the 10th of January last, said:

"Recovery is undoubtedly, and will be, one of the first necessities of the whole of Europe"; again, "The exhaustion from which all the belligerents will undoubtedly suffer will lead to a period of great effort and I hope in all of them—I say without distinction 'in all of them'—to a greater degree of recovery"; and again, "I believe we have it within our capacity to make up for the vast losses which we have incurred in a shorter period of time than any other state."

The president spoke of industrial enterprise in general, but mining, which is our second greatest industry, for I suppose we must put agriculture first, should be made to contribute more to industrial regeneration and advancement.

The war has emphasized one outstanding fact, viz., that we should and could approximate more closely to the ideal state of being self-supporting; in other words, develop to the utmost our natural resources and put them to the most economical use at home.

Great Britain, and more especially England, is the most highly mineralized area in the world. No other country contains such a variety of mineral resources of use to mankind, not even the United States of America. Other countries may contain vastly greater quantities of one or more of the useful minerals, but no country so many and so varied. If we extend our view and take in the whole British Empire, there is no fuel, ore, stone, or clay which is not contained therein. Mr. Runciman has said:

"There should be no essential article, either for the arts of peace or for the arts of war, upon which we cannot within the Empire lay our hands." He said further:

"In the course of the afternoon, reference has been made to the production of raw material in this coun-

try. The control of metals passed to Frankfurt years ago. It was Frankfurt that really dictated the production of metals in many parts of the world. Even in our own Dominions, the influence of Frankfurt in Australia was so great, that the Australian Government went to the extreme length of cancelling by legislation every contract on the outbreak of the war in which the great metal organization of Frankfurt was concerned. We have control within the British Empire of some of the most valuable metals on which we now depend—manganese from India, tungsten from the Antipodes, zinc in large quantities from Australia, and nickel very largely from Canada. I should like to say, so far as these metals are concerned, that nothing could have been more whole-hearted than the support which has been given to us by the Dominions. Long ago, at the beginning of the war, we pointed out to them how largely we were dependent on them and how short our supplies might be if they were dissipated too widely, and they at once, without any hesitation, took the most drastic action, so that we have an abundance of manganese here; tungsten we can get now in sufficient quantities; zinc is being produced in increasing quantities every month."

It behooves us, therefore, to know exactly where we stand in respect of our mineral resources; where the different kinds of minerals occur, of what quality, and to what extent. A great deal of information exists on the subject in the transactions of various technical institutions, in geological memoranda, and in reports on mining properties, which, in the hands of a body of mining experts, could be summarized so as to form part of a large work resulting from further inquiry and investigation.

In respect of some of our ores there is room for improvement in the methods of extraction of the ore from the gangue or stone, and the economic reduction of the ore to the metal. The decision of the Advisory Council to the Committee of Scientific and Industrial Research of the Privy Council, to make a grant in aid of the Research which the Institution of Mining and Metallurgy and the Royal Cornwall Polytechnic Society are conjointly about to carry out in respect of the economic production of tin and tungsten, with special reference to Cornwall, is a welcome sign of the national awakening which is taking place as to the overwhelming importance of scientific and industrial research.

I will quote several expressions of faith from the Memorandum, setting forth the question of research, which was issued by the Board of Education on the 23rd July last.

"There is a strong consensus of opinion among persons engaged both in science and industry that a special need exists at the present time for new machinery, and for additional State assistance in order to promote and organize scientific research with a view to its application to trade and industry."

Again: "It appears incontrovertible that if we are to advance or even maintain our industrial position we must as a nation aim at such a development of scientific and industrial research as will place us in a position to expand and strengthen our industries and to compete successfully with the most highly organized of our rivals."

*Extract from the Presidential Address, Institution of Mining and Metallurgy.

And again: "It is essential that the Advisory Council should act in intimate co-operation with the Royal Society and the existing scientific or professional associations, societies and institutes, as well as with the universities, technical institutions, and other institutions in which research is or can be efficiently conducted."

That these are no mere empty expressions of opinion is shown by the action taken by the Council of Scientific and Industrial Research in assisting our proposed scheme of investigation on tin and tungsten. And sentiment has been still further translated into action by a proposal to set up committees of experts in certain branches of industry to advise the Council for Research on matters relating to these industries. In connection with the industries of mining and metallurgy, it has decided to set up a committee to deal with (a) the mining of non-metals, (b) metalliferous mining, and a committee for metallurgy dealing with (a) the metallurgy of non-ferrous metals and (b) the metallurgy of iron and steel, and has requested our Council to nominate two members to serve on the Metalliferous Mining Committee and two to serve on the committee relating to the metallurgy of non-ferrous metals, a request to which we have very willingly acceded.

The action of the late President of the Board of Education in securing the appointment of the Advisory Council to the Committee of the Privy Council to ascertain the best methods of securing the organization and development of Industrial and Scientific Research marks a welcome development and may lead to great strides being taken in our industrial methods. But it is not sufficient to organize industry and inaugurate research if we have not the material in the shape of highly trained persons to undertake research work, organize and captain industry. Great improvements in our educational system have been carried out during the last twenty years. One has only to point to the rise of the provincial universities with their great Applied Science departments to instance this, but we are still behind some of our continental neighbors; the modern side of our public schools is not what it should be, and the cost of our higher education generally is excessive.

Sir James Dewar, in his presidential address to the British Association in 1902, said that "the really appalling thing is that the German population has reached a point of general training and specialized equipment which it will take us two generations of hard and intelligently directed educational work to attain. It is that Germany possesses a national weapon of precision which must give her an enormous initial advantage in any and every contest depending upon disciplined and methodical intellect."

But, as the editor of a well-known technical periodical in a recent article, in alluding to these words, pertinently asks, "Does the nation realize this? For not until it does, shall we be able to ensure that State recognition of science without which all the committees under the sun will be but ploughing the sands."

I think the nation does now realize the effectiveness of the weapon possessed by Germany. If this great war has not brought this home to us nothing else will.

I will conclude by quoting, and adapting to my theme the words of one who, if we accept the estimate of Lord Macaulay, was the wisest of mankind, Francis Bacon, who closed his essay on 'The True Greatness of Kingdoms and Estates' with these words:

"No man can, by creating, as the Scripture saith, add a cubit to his stature, in this little model of a man's

body: but in the great frame of kingdoms and commonwealths it is in the power of princes or estates, to add amplitude and greatness to their kingdoms. For by introducing such ordinances, constitutions, and customs as we have now touched, they sow greatness to their posterity and succession. But these things are commonly not observed, but left to take their chance."

HYDRAULIC GOLD-MINING PROBLEMS AT ATLIN, B.C.

The Mining and Scientific Press, San Francisco, recently printed the following:

"The Solution of Some Hydraulic Mining Problems on Ruby Creek, British Columbia,' is the title of a paper written for the Arizona meeting of the A. I. M. E. by Chester F. Lee and T. M. Daulton, of Seattle, Washington. This district is 17 miles east of the town of Atlin. Gold was found there in 1898, and the output to date from placer mines is \$4,518,000. The great width of the deposit (250 feet), flood-waters, poor pumping facilities, and large boulders were the difficulties. These were overcome by dividing the ground up the creek into two series of pits. First one was sluiced for 400 ft., then the other was started, working alternately. The boulders are blasted when the pits become too full of them. In the flood season only one pit is worked, an arrangement of sluices allowing the excess water to go to waste. The gold-saving sluice-boxes, 42 in. wide, are lined with carbon-steel (0.9 per cent. carbon) plates, in place of spruce blocks used previously. After a season's wear (150 days), when 67,940 cubic yds. of gravel flowed over them, the plates showed an abrasion of 1-32 in. In 1915, 6,380 boulders were drilled and blasted and 21,955 'bulldozed' without drilling. In two years the average was one boulder for every 2.5 yd. of gravel moved. Sullivan DA-19 40-lb. hammer-drills are used. All costs in 1915 totalled 47.6c. per cu. yd. The property is owned by the Placer Gold Mines Co., of Seattle, and Mr. T. M. Daulton is manager in charge of operations."

(Note—Our British Columbia correspondent, who sent the foregoing clipping, states that he believes Messrs. Lee and Daulton have inadvertently understated the value of the placer gold recovered from the Atlin field. Instead of \$4,518,000, as quoted above, it is \$6,540,000 for all years, 1898-1915, both inclusive. To end of 1914, the figures that have been printed yearly in the Annual Report of the Minister of Mines for British Columbia, total \$6,163,000; the output in 1915 was \$377,000, which last figures, however, have not yet been published by the department. The total of \$6,540,000 is that for all Atlin gold-bearing creeks for all years under notice.)

GOLD IN GAUTHIER TOWNSHIP.

New Liskeard, May 20.—Considerable excitement was created here a few days ago in mining circles over some gold samples brought to town from Gauthier township by Mr. Wm. Margarett.

The location of the discovery in this township is about three miles from the halfway house off the Crystal Lake road, on the property adjoining the Andrew's claims.

Messrs. Margarett, Elstone and Duncan, the owners of the claims where the discovery was made, returned north this week. It is said that the formation is Keewatin schist and dolomite and quartz.—Cobalt Nugget.

THE PAS

The Pas, Manitoba, May 19.—Mr. J. E. Spurr, vice-president and advising engineer of the Tonopah Mining Company, is expected here on June 1st. Mr. Spurr has been in South America since his visit here last fall.

McMillan Brothers are hiring 475 men in The Pas to work on the last stretch of grading the Hudson's Bay Railway. Nearly 300 of the men went north on the Muskeg Wednesday, and the balance will be shipped out by special train on Sunday. It takes all the surplus labor out of the town. There are forty-five miles of grading to be done, and work will commence about June 15th.

Development work on the molybdenite claims of the Tonopah north of Herb Lake will be undertaken next week, when Geo. Bancroft will take up a gang of men. These claims were secured from R. Kerr.

Reports from the diamond drills at Flin-Flon and Schist Lake say the work is going ahead without a hitch. At Flin-Flon the drills are on their eighth set, and the orebody is considered fairly well proven up. The average vertical depth attained is put at 900 ft. That the body is lenticular is indicated at both places. The Schist Lake drill is at its third set of holes. Mr. Callinan says the ore is very heavy at Flin-Flon, only taking seven and a half cubic feet to make a ton. He thinks the permanency of the deposit is well established.

To make an examination of the gold district at Herb Lake, Messrs. Kerr, Nash and Hassett went up on a jigger Monday afternoon. Mr. Nash is the Alaska engineer acting for D. C. Jackling.

The deal for the Rex group, which was almost closed but a week ago, is now off altogether. Mr. Gordon, who was making the sale, left for the south on Monday, quite disgusted that his efforts were fruitless. Hassett refused to consider the alternative cash and stock proposition, and Moore wired his refusal also. Campbell, the third partner, is up at Reed Lake, but he left power-of-attorney here with the Union Bank. Thus, for the umpteenth time, the sale of the Rex tumbled down at the last moment. Whoever gets the properties will get a run for their money, but so far the buyers want to run in stock certificates, which are sold at the printeries at \$10 a thousand.

Bancroft and Callinan, between them, registered twenty claims staked in the sulphide area. Both men are in close touch with what the diamond drills are doing, and this sudden activity in claim-staking indicates their strong faith in the results obtained so far.

Tuesday's Ross boat carried away the "first families" of Flin-Flon. They were Mr. and Mrs. Callinan and sister, Mr. and Mrs. Woods and P. J. Maloney. The Callinans will live in a tent for a while, and the Woods have a shack. To Mrs. Snell belongs the distinction of being the first white woman resident at Flin-Flon. She went in in March, and is camped with her husband near the drills.

Recorder Barker set a record day for receipts on Monday, when he took in \$125.

Incorporation of three mining companies, with a small capital, is announced in the Manitoba Gazette. They are the Canadian Gold Pan, Chicamon Mining Ltd., and Hinterland Mines and Holding, Ltd. The total capitalization of the three reaches \$30,000 only. None of the companies are known locally, though the name of the Hinterland Mining Company suggests some connection with this district.

Mr. and Mrs. John Hammell are in New York after a two-weeks' holiday at Atlantic City. They expect to arrive in The Pas towards the end of the month, to spend the summer at Flin-Flon.

It is hardly likely there will be any considerable rush into the mining districts surrounding The Pas this summer. Normal activity in prospecting is now going on, and, unless a motherlode is picked up, the looked-for rush will be deterred until next spring. The results of the diamond drilling north of here will prove a determining factor in attracting Canadian-wide attention to the district.—The Pas Herald.

HOLLINGER IN 1915.

In his report for 1915 Mr. N. A. Timmins, president of the Hollinger, says:

"Underground developments during the year have shown most satisfactory results. Estimated ore reserves have been increased from \$13,358,420 at the beginning of 1915 to \$16,031,600 at the beginning of 1916. You will find in the General Manager's report, the statements, 'the entire volume of ore so far removed from the mine is the equivalent of approximately the first 160 feet below the surface,' and 'there still remains above the 300-ft. level a greater tonnage than has been removed from the mine,' and further, 'our entire production containing \$9,778,783 may be considered to have come from the equivalent of the first 200 feet of depth.' These facts, coupled with the discovery of new ore bodies, and the opening out at depth of the old ones during the past year, tend to reduce to a certainty our firm conviction that thus far we have only seen the commencement of operations. We congratulate those shareholders who have had the faith to retain possession of their stock, in spite of the opportunity to dispose of their holdings at a greatly advanced market valuation. Shareholders need not be in the least perturbed over the falling off in the grade of the ore shown in the estimate of reserves. The reduced working costs have made it possible to include in the estimates ore which could not be included three years ago. With working costs as they were, in the vicinity of \$6.00 per ton, it is evident that no profit could accrue from working \$6.00 rock, but with costs reduced to less than \$4.00 per ton, it is equally evident that \$6.00 rock may be worked at a handsome profit, and is rightly included with the higher grades of ore, in the estimated reserves.

"An interesting feature of the General Manager's report is the comparison between what has been accomplished since milling operations were first started, and what was presaged in the first Annual Report, issued in January, 1912. It is very evident that the promise made in the First Annual Report will be more than fulfilled during the coming year, and all who are interested in the progress of the company will, we feel, be disposed to join in congratulations to Mr. Robbins and his able assistant, Mr. Globe, that they are able to now prove the accuracy of their estimates and deductions, which at the time of publication may have appeared to those unacquainted with the facts to be unwarrantably bold."

BOSTON CREEK.

According to information received from Boston Creek, Messrs. J. P. Bickell & Co., of Toronto, have exercised their option on the Giovanazzo claim at Boston Creek. The sum involved is understood to be \$10,000, which amount, it is said, was paid over on Thursday.—Cobalt Nugget.

ENCOURAGING PROSPECTORS IN BRITISH COLUMBIA

Victoria, B.C., May 11.—The vote to cover the expenses of the parties of mining engineers who are to be sent out by the Government to make detailed reports upon mineral resources in different parts of the province is contained in this year's estimates. Hon. Lorne A. Campbell, Minister of Mines, announced soon after his appointment to the portfolio that he proposed to have this work carried out and with that purpose had an appropriation placed in the estimates.

It is the intention that the engineers shall make investigations of promising mineral areas and prospects and that their reports shall be available to the prospector and others who may be interested. Through these reports, it is pointed out, the prospector will be informed as to whether it is worth while to proceed with work and in cases where he is endeavoring to secure capital he will be able to use them as a reliable basis upon which to approach the capitalist. A prospector who can back up his representations to capitalists with a Government report upon his property will, it is pointed out, be in a much better position than if no such report were available. The engineers' reports are thus expected to be the means of bringing in new capital.

The whole province will not be covered in one year or two years, but a start will be made this summer with four parties of engineers who will commence work directly they can be engaged and the weather conditions are favorable.

Mr. Campbell has received numerous letters, congratulating him upon the decision to give two free assay certificates to prospectors with each certificate of work. Prospectors who have written welcome the opportunity to secure free Government assays. Arrangements are now being made to provide for this extension of the Government's program to assist prospectors and others in the development of the mineral resources of the province.

Free advice to prospectors from Government engineers is another move toward developing mining which Mr. Campbell is inaugurating. This year such advice will be given by the engineers who carry out the investigations and make reports upon various mineral areas. From them the prospector will be able to get many valuable hints concerning his property and the best method of proceeding with its development. This plan of giving free advice will be extended as Mr. Campbell further develops his plans.

The bill to provide for the leasing of reverted crown granted mineral claims has met with general approval. For \$25 a prospector may secure for one year a lease upon a mineral claim which has reverted to the Government for non-payment of taxes. During the year the prospector can do sufficient work to enable him to decide if the property is worth taking up. If he is undecided at the end of the first year he may lease it on the same terms for another year but a limit of two years is placed on the lease period. If the prospector decides he wishes to secure title to the claim all he has to do, provided he has worked the claim during the lease period, is to pay up the taxes due up to the time he took the lease. He is charged no taxes during the lease period, if he has worked the claim. He secures crown grant for the overdue tax charges only, no fee being charged for the crown grant, which is considered to be covered by the \$25 he pays for the lease.

This figure was decided upon because it is the amount of the crown grant fee and because it is necessary to make some charge to provide against claims being tied up and held for speculative purposes. Because no crown grant fee is charged the \$25 is in effect remitted at the end of the lease period if the prospector decides to take title to the claim.

Under this new system the prospector is able to work on a reverted crown granted claim with the assurance that if he discovers anything that is worth while he will be protected against having the claim taken away from him by some more wealthy individual or corporation who might, under the old plan, outbid him in the public tenders which were formerly called for. No person may take a lease or an interest in a lease on more than two claims in any one mining district, so that the new Act will benefit the prospector and the small man.—Nelson Daily News.

LA BELLE KIRKLAND.

At the 270-ft. level the La Belle Kirkland mine at Goodfish Lake is drifting on the same vein as has been followed down the shaft all the way. Drifts are being run east and west on the vein, one machine being run in each drift. Each drift is between 40 and 50 feet long now and the foot wall streak is carried in the face of both drifts. Crosscutting has just been started to cut other streaks of high-grade ore which were followed in the shaft and at upper levels. Three or four of these streaks are shown to exist by the shaft and the cross-cutting down at the 100-ft. level. They are very consistent both in width and value. Between these streaks the rock is not of very good grade, but the streaks themselves are high grade enough to make a good milling average across the drift.

The fault, which developed in the shaft below the 200-ft. level, was easily disposed of. The drift at the 270-ft. level cut the foot wall streak 27 feet from the shaft so that it was quite unnecessary to cross-cut for it. The shaft is down 350 ft. and will be sunk still further when the work in the drift is a little further advanced.—Northern Miner.

ON WEST DOME.

Cobalt, May 20.—A strike of the utmost importance has been made on the West Dome Consolidated mine. In the course of diamond drilling at an angle of 60 deg. an orebody approximately 5 ft. wide has been cut at a depth of 515 ft. The core shows that across this width the values were \$45 a ton.

The shaft is down to about 200 ft. on the incline. The vein there is showing considerable free gold and is heavy in fine sulphides, making a good grade across two to three feet.

It is believed that the ore cut with the diamond drill is the same as in the shaft. If this is so, the future of the property appears to be very bright. The diamond drill has been removed to another point on the property, set up, and is now working again. The plant, which had deteriorated a good deal while it was lying idle, will have to be replaced by a larger and better equipment as soon as sufficient depth has been attained in the present shaft. The recent discoveries will certainly hasten the installation of this plant, as the property now warrants much increased expenditure.—Northern Miner.

RECENT PROGRESS IN FLOTATION*

By Robert J. Anderson.

One of the most marked and revolutionary advances of recent years in the art of concentrating ores is the advent and application of the flotation process. Although the basic and essential principles of flotation had been disclosed by the early work of Haynes, Everson, and the Elmore brothers, it is only within the last decade or so that the process has been a commercial success. Historical considerations point out the fact that the installation of the Delprat process, in 1903, at the Broken Hill Proprietary mine in Australia, was probably the first important commercial application of any flotation process; some other installations were also made at or about the same time. Flotation as practised to-day is the result of the diligent labor of many men, and the present state of development cannot be ascribed to any one individual. In its early stages the flotation process of concentration was decidedly uncertain of success because of certain inherent difficulties which were to be overcome. At present every mill owner in the country is considering its applications. The froth flotation process is markedly efficacious in extracting the mineral sulphides from slimes, and, in the main, is more or less restricted to the treatment of extremely fine material.

In a general way, there are three divisions into which the flotation processes may be separated: namely, (1) film flotation (2) bulk-oil flotation, and (3) froth flotation. Further, these three classes blend into one another gradually, according to the patents secured for the different processes. Technical distinctions are based on such points as these, viz., acid, neutral, or alkaline pulp solutions; mill temperature or hot solutions; various secondary apparatus employed for the introduction of air or the production of gas bubbles; amounts of oil; and other minor differences almost ad infinitum. The more important processes which have so far survived elimination by litigation or other means include the following: Minerals Separation process; Potter-Delprat process; De Bavay process; Callow pneumatic process; Hyde process; Janney process, and the Macquisten tube process; and, further, the preferential processes—Murex, Lyster, and Horwood. These processes have been described at length in the patent literature, in the scientific press, and elsewhere, and further comment would make this writing unnecessarily cumbersome.

Strictly speaking, the subject of flotation naturally falls into two divisions, to wit, legal disputes and technology. Litigation has undoubtedly been the most active, as well as destructive, movement in the field, for the development of the process has been constantly attended with an unwholesome amount of legal differences among the contending interests. Probably there was never a technical achievement so hotly contested in the courts as this one. All these involved disputes have so distinctly retarded progression in this process that, charitably speaking, flotation is to-day in a chaotic state.

Regarding present operations, although there are so many flotation plants at work, there is a decided dearth of available data. In short, actual results have not found their way into the literature devoted to mining and allied subjects, presumably on account of the veil of mystery which is supposed to, and actually does,

hang over the process. Practice varies with the locality, and, as a whole, the methods are in no sense standardized. Development at the present time is being retarded on account of certain cases pending in the courts, which involve the Minerals Separation, Ltd., and others. For, with these cases still to be adjudicated, many operators seem to hold that any attempt at development and standardization would be folly, which would incur a certain waste of time and money, should the decision be rendered in what is considered the unfavorable way.

To all intents and purposes Australia is in the van in flotation at present, and has been since the advent of the process. The first important flotation installation was that of the Delprat process, as mentioned in the foregoing; this mill operated successfully from its inception and has continued to do so. The joint Potter-Delprat process was also applied to the treatment of ore at the Broken Hill Proprietary Block 14 Company's mine in 1903, but ceased operations in 1905; whether this particular plant ever recommenced operations is not known to me. These installations, however, mark the beginning of the remarkable growth in the zinc industry of Australia, which country now produces one-fifth of the world's supply of spelter. The Potter-Delprat process is peculiarly adapted to Broken Hill ores, and this fact is the main reason for its marked success; on other ores it may not be as efficient as some of the other processes.

The Minerals Separation process, licensed by the Minerals Separation, Ltd., and the Minerals Separation American Syndicate, Ltd., was first employed about 1904-05 by the so-called Sulphide Corporation of Australia. In brief, the process then was an adaptation of the Cattermole patent, the principle of operation being the coagulation and sinking of the mineral sulphides with a large amount of oil. The original idea of Cattermole was abandoned in 1905 and true froth flotation adopted. The Minerals Separation process was practised in 1907 at the Central mine at Broken Hill, and has operated successfully to date, producing zinc concentrates. At the same time the Minerals Separation, Ltd., by right of purchase secured a large tailing dump from the Sulphide Corporation; the Minerals Separation process was applied to the concentration of the material, and the mill was an immediate success, producing good concentrates. During this time flotation was subjected to rigid experimentation throughout the Broken Hill district, and the practicability of the process was satisfactorily demonstrated. Minor improvements made from time to time have brought it to its present state of perfection.

The importance of the zinc industry of Australia to-day is due in great measure to flotation, for in less than a decade Australia has risen to the position of furnishing one-fifth of the world's supply of zinc. No mining camp in the world produces so much zinc as Broken Hill. The first shipment of zinc concentrate in 1903 from that place was 50 tons; in 1911, 470,000 tons of 47 per cent. grade zinc concentrate were produced by flotation methods.

Flotation has gone forward rapidly in Arizona in the last few years, and there is at present great activity in that state because of recent large installations. A

*Extracts from a paper published in the Journal of the Franklin Institute, May, 1916.

noteworthy flotation plant is that of the Inspiration Copper Company, near Miami, Ariz. At this place there are available some 100,000,000 tons of a 1.63 per cent. copper ore, the copper being mostly in the form of chalcopyrite and containing about 0.20 per cent. copper as silicate and carbonate. A large amount of experimental work was first performed previous to the erection of the present mammoth mill.

The Inspiration process was designed by the metallurgists in charge and was intended to embody the best features of the other machines without infringing on any of the patents except those of the Minerals Separation, Ltd. The Inspiration Company is licensed to operate under the patents of the latter. The present new mill has a capacity of 7,500 tons daily, and when the entire plant is in operation will have a capacity of some 14,000 to 15,000 tons. In addition, the experimental unit is still operating.

Flotation has become an important metallurgical process in the Coeur d'Alenes and elsewhere in Idaho. The Callow pneumatic process was applied to the treatment of ores at the mill of the National Copper Company at Mullan, Idaho, the plant being started April 10, 1914. This was the first Callow plant ever erected and was an instantaneous success. Since that time the pneumatic process has been adopted by nearly all the other mines treating lead and lead-zinc ores in the Coeur d'Alenes, notably the Caledonia, Bunker Hill and Sullivan, Gold Hunter, Morning, Hercules, and others. The plant erected by Callow for the National Copper Company had eight regular rougher cells and two cleaner cells, treating some 500 tons in 24 hours with a consumption of as low as 0.13 pounds of refined pine oil per ton. The Callow scheme finds favor in the district for the flotation of slimes and fine sand.

One of the most remarkable and efficient flotation plants in the United States is that of the Butte and Superior mill at Butte, Mont., operating on a lead-zinc ore. The early experiments of James M. Hyde, conducted at Basin, Mont., led to the introduction of flotation at the Butte and Superior mill. A 1,000-ton-per-day plant is working on the treatment of a zinc middling product as an adjunct to concentration with tables and other mill apparatus. The original recovery was only 60 per cent., but with the flotation end of the scheme operative this has been increased to 91 per cent. and more. This mill now uses the so-called Janney frothing machine, and for that reason the company is involved in legal controversy with the Minerals Separation, Ltd., the latter holding that the Janney cells infringe the Minerals Separation patents. No decision has as yet been rendered.

In this flotation process the pulp passes through agitators and thence to a bank of five flotation machines operating in parallel. The first rough concentrates are recleaned, and also the first tailings; a system of clean and reclean operates with the production of clean concentrates, a middling product, and tailing; the middling is returned to the system. The 55 flotation machines are supplied by six agitators through a distributing system. The frothing is performed in mill temperature solution with pine oil as the collecting element; copper sulphate and sulphuric acid are also added.

Another plant, in partial operation, is the 800-ton-per-day plant of the East Butte Copper Mining Company. The Janney type of frothing machine is in use for the treatment of second-class ore and dump tailings.

The large plant recently constructed by the Anaconda Copper Mining Company at Anaconda, Mont., is a noteworthy development in this state. The old mill is being remodelled and the flotation process being added to each of the mill sections; each section has a capacity of 2,000 tons of feed per day. Each section of the flotation plant has four Minerals Separation machines, 15-cell type; the froth from these machines was cleaned in six Callow pneumatic cells, but the pneumatics have been abandoned and only one clean concentrate is now made. The reagents used in the flotation are: about 6 to 8 pounds of 50 deg. B. sulphuric acid per ton of feed, plus 2 to 3 pounds of kerosene-sludge acid, and 0.5 to 1 pound of wood creosote. Part of the wood creosote is added to the Hardinge grinding mills, and the remainder to the Minerals Separation units. The pulp is heated to about 70 deg. F. The flotation concentrate is thickened in Dorr tanks and dried in Oliver filters.

The flotation work in Utah centres about the United States Bureau of Mines and the General Engineering Company in Salt Lake City. The experimental work at the Bureau of Mines, under the direction of Mr. Dorsey A. Lyon, has contributed much to the scientific knowledge and working technic of the process.

In California the plant of the Engels Copper Mining Company is operating under Minerals Separation patents and licenses. This plant is interesting, as it is the only one in which no other process than flotation is used. The ore was not amenable to ordinary wet concentration, but is being successfully treated by flotation.

That flotation has penetrated the Orient is shown by the plant of the Mitsui Mining Company at its Kamioka mine in Japan. This mine has a yearly output of some 10,000 tons of an ore averaging 10 to 16 per cent. Zn and 3 to 4 oz. Ag.

The main amount of work with flotation in Nevada has been experimental and has been done at the mill of the Nevada Consolidated Copper Company, embodying mainly the practice of the Inspiration and Ray Consolidated plants.

Flotation has been an active factor in the mining industry of Colorado for a few years, and flotation plants are in operation at such places as the Hudson mill and Newton mill at Idaho Springs, the Sunnyside mill at Eureka, Gold King Leasing Company at Silverton, and others too numerous to mention.

A Minerals Separation process has been practised at Britannia Beach, British Columbia, by the Britannia Mining and Smelting Company.

The plant of the Braden Copper Company at Sewell, Chile, South America, is an 8-cell Minerals Separation process floating copper sulphide.

Oils in Flotation.

The importance of oils in flotation work can scarcely be overestimated, since most or all of the different processes have come to the use of oils. Since almost any kind of oil may be used to effect a separation of the finely-divided sulphides from the gangue, it is not surprising that the number of different oils, which have been tried experimentally and commercially, is almost without end. The present tendency is to determine by trial a suitable oil mixture for a given ore. It is found that the coal-tar products are particularly efficacious in the flotation of copper ores, but are not so good for lead and zinc. In the flotation parlance, oils are divided into two kinds, namely, (1) frothing oils and (2)

collecting oils. There may be a further classification of each of the above into such types as mineral oils, animal oils, and vegetable oils. One oil in itself may combine both the properties of collecting and frothing, so that at times there may be difficulty in stating whether an oil is a frothing oil or a collecting oil.

1. Frothing Oils.—A number of oils have been successful frothing oils, and these include the pine oils—steam refined and crude—cresylic acid, and turpentine and other pyroligneous products from the distillation of woods. The coal-tar phenols and most or all of the essential oils are efficient frothers. The essential oil of the *Eucalyptus globulus* finds wide application as a flotation oil in Australia on account of low cost; it would be prohibitively costly to use it in this country. Pine oil is unquestionably the best frothing agent known, but has recently become prohibitively costly, and the same is true of cresylic acid. In general, the essential oils give a coherent froth and satisfactory extraction.

2. Collecting Oils.—The mineral and tar oils have a marked selective action on the mineral sulphides and are generally poor frothers. The mineral oils used in flotation include crude petroleum, refined oil, gasoline, kerosene, creosol, and coal tar and coal-tar creosotes. Oils derived from the destructive distillation of wood, such as wood creosotes, pyroligneous acid, and similar products, are good flotation oils from the standpoint of cost and efficiency. Coal tar has the property of stiffening a weak froth, and may be employed as a mixture with 10 per cent. pine oil.

Recent commercial practice demonstrates that acid may be eliminated from the pulp solutions if a suitable oil mixture be determined. The same results can evidently be obtained in an alkaline or neutral pulp as in an acid one. The flotation experts employed in the erection of plants have come to the practice of using, in the work at hand, the oil available. An instance is given where power is generated at a certain plant using Deisel engines, and the practice has become so fixed now that the same oil is used for flotation as is used in the Deisel equipment. Evidently no given oil or combination of oils will perform effective work on all ores; it is a particular problem for each ore to find the most suitable oil mixture.

It is the conviction of at least one large company supplying oils for flotation consumption that there are too many oils on the market, and that a medium-price oil (20 cents per gallon in tank cars) will be the frothing element which large consumers will favor. It is the consensus of opinion that pine products are essential to the production of good froth, and are also good selective oils. Considerable difficulty is experienced by the consumers in the duplication of orders, for it seems as though the oil companies cannot or do not furnish the same oil on repeated orders. Why this condition of affairs should obtain is not apparent.

Grinding.

The present practice favors the ball mill for grinding the tailings or other material to be floated, as the bulk of the feed is thus reduced to slime, which is the ideal feed for froth flotation. The use of Dorr thickening tanks for thickening the pulp, placed in closed circuit with the grinding mill, seems to be a present tendency for a future standard practice. The fact that flotation can and does work best on slimes has removed the old dread of mill operators for making slimes in the wet concentration; this will result in some minor changes in mill practice.

Dewatering.

Before shipment to smelter or other market, flotation concentrates must be dewatered by filters to a moisture content of about 8 to 10 per cent.; otherwise, heavy freight bills are incurred which might consume the profits. The moisture content cannot be too low in the case of long shipments, or heavy dusting losses will take place. The so-called Oliver filter will reduce the moisture to 8 per cent. or less, and is preferable to the pressure type of filter on account of the excessive operating cost of the latter.

Smelting Concentrates.

In smelting flotation concentrates for the recovery of the values therein, the ordinary practice is adhered to, pendent on the nature of the values—zinc, copper, lead, etc. The best practice recommends drying the concentrate before charging into a reverberatory or other furnace, i.e., it is best to charge a hot calcine. If it is desired to reduce the sulphur content, calcines can be made in the ordinary McDougal or Wedge multiple-hearth furnaces.

Application of the Process.

Generally speaking, the mechanically or air-agitated machines require fine material for successful performance, i.e., 60-mesh or finer. In other words, most of the flotation processes are pre-eminently suited to the recovery of slimes. It would seem as though the flotation process should be used as an accessory unit in wet concentration, as an all-sliming plant, with few exceptions, is not an economic possibility in this country. The matter of rougher and cleaner cells is strictly a local consideration and must be determined separately for each individual plant. Two cogent factors enter into the solution of this problem; to wit, richness or leanness of the slime feed and proximity or remoteness from smelters. The dual, clean and reclean method, was tried at Anaconda and finally abandoned in favor of the single cleaning method.

Broadly, flotation has now reached a stage so as to find wide-spread commercial application. It is a noteworthy fact in the history of milling that such an apparently simple process should have such a ramified development in such a short time. There can be no question that flotation in due time will be a necessary adjunct in all the mills in the mining industry. Already the process has added greatly to the world's wealth. From its inception to date it has produced about \$20,000,000 in silver, \$1,700,000 in copper, \$612,000,000 in spelter, and \$19,800,000 in lead.

The B. C. Portland Cement Co. (in liquidation), with works at East Princeton, Similkameen, British Columbia, has been given authority by a Supreme Court judge to lease to the British Columbia Copper Co. the steam-generating electric power plant which is part of the equipment of the cement manufactory established two or three years ago east of Similkameen river below Princeton, from which town it is distant about four miles. The B. C. Copper Co. is constructing a pole line from its mining properties on Copper mountain, down to East Princeton, a distance of about twelve miles. Much underground development is being done by the mining company on Copper mountain, including driving a tunnel 2,000 feet to further develop large orebodies already prospected. With power provided for running a compressor and other machinery on Copper mountain, underground work will be much expedited, and the big orebodies be much more extensively opened than by hand-drilling.

HOLLINGER MINING COSTS IN 1915

The costs per ton milled are not absolutely correct in all details, as they include the cost of breaking 35,-170 tons of excess ore and 42,424 tons of waste in de-

The price of explosives has advanced steadily, and this advance has increased the cost of mining by fifteen cents per ton over what it would be with normal prices ruling.

The following table shows the distribution of the costs of mining at the Hollinger in 1915—

Account.	Labor.	Stores.	Totals.	Per ton of ore milled.
General mining charges.....	\$6,970.91	\$3,871.65	\$10,842.56	\$0.032
Superintendence	12,785.25	.....	12,785.25	.038
Diamond drilling	5,792.24	7,676.22	13,468.46	.040
Crosscutting	10,490.19	13,728.63	24,218.82	.072
Shafts	8,006.43	6,433.99	14,440.42	.043
Drifting	27,355.66	31,454.96	58,810.62	.176
Raising	8,239.00	6,672.23	14,911.23	.045
Winzes	8,469.69	5,222.07	13,691.76	.041
Back-filling	302.79	291.59	594.38	.002
Timbering and repairs, shafts...	6,511.29	12,339.67	18,850.96	.056
Stoping	109,359.07	116,911.60	226,270.67	.676
Scaling	8,552.34	.....	8,552.34	.026
Timbering and repairs, stopes ..	24,629.77	13,053.57	37,683.34	.113
Track laying	6,267.32	7,232.71	13,500.03	.040
Trammig and mucking	103,685.66	1,256.16	104,941.82	.314
Pipe-fitting underground	3,639.17	7,010.37	10,649.54	.031
Mine drainage	3,570.97	6,679.39	10,250.36	.031
Hoisting	37,065.77	15,641.93	52,707.70	.158
Landing and dumping	4,424.63	749.69	5,174.32	.015
Drill repairs	2,471.67	15,729.49	18,201.16	.054
Sharpening Steel	16,947.50	6,758.55	23,706.05	.071
Collecting steel	10,057.37	93.94	10,151.31	.030
Mine sampling	5,152.50	.....	5,152.50	.015
Assaying	1,117.40	670.57	1,787.97	.005
Change house	994.71	2,523.53	3,518.24	.001
Surveying	4,505.06	1,255.93	5,760.99	.017
Mine lighting	326.31	5,117.33	5,443.64	.016
Electric haulage	4,441.99	582.42	5,024.41	.015
	\$442,132.66	\$288,958.19	\$731,090.85	\$2.183
Less credit for excess ore and waste rock broken.....			95,800.00	.285
Net cost of mining			\$635,290.85	\$1.898

velopment. A deduction of \$95,800.00 from the total cost of mining is therefore shown, to cover these items.

The following unit costs are given as a matter of interest:

Diamond drilling, including power, diamonds, labor, per ft.	\$1.60
Cross-cutting, including power, explosives, labor, per ft.	6.40
Shaft sinking, including power, explosives, labor, per ft.	42.32
Drifting, including power, explosives, labor, per foot	10.10
Raising, including power, explosives, labor, per foot	16.17
Winzes, including power, explosives, labor, per foot.	39.20
Stoping, including power, explosives, labor, per ton	.70
Mucking and trammig, power and labor, per ton	.28

During the month of April, 1915, an electric locomotive haulage system was started underground. The result has been a saving of seven cents per ton in trammig costs. This amounts to a total of \$26,389.58 saved.

HOLLINGER MILLING COSTS

Commenting on results of milling operations, General Manager P. A. Robbins says:

"During the year there were stacked for re-treatment 9,500 tons of concentrates, having gross gold contents amounting to \$81,763.00. We have now altered our concentrate treatment plant so that it is no longer desirable to stack this product for future treatment, and we shall as rapidly as possible reclaim those concentrates which have been conserved during the past two years. The cost of treating Hollinger ore amounts to almost exactly \$1.00 per ton and it is expected that the present year will record a somewhat lower cost. All milling costs have been charged to the ore treated, and no reductions in costs have been made on account of profits made by milling Acme ore, these having been credited to General Charges. The alterations reported last year as being in progress were completed in April, since which time 100 stamps have been in regular operation.

"We are now installing extra tube mills and screening plant, by means of which it is proposed to relieve the stamps from the duty of further crushing on that portion of the ore which comes from the crushers in

a condition fine enough for direct tube milling. The continuous decantation plant is being increased by the addition of two rows of 40-ft. tanks. Six Dorr agitators, 26 feet in diameter by 18 feet deep, have been installed to secure a longer period of treatment for the ore. The concentrating plant has been rearranged to make room for the agitators, and a tube mill has been installed in circuit with two smaller agitators for treating concentrates. It is expected that by means of these alterations the capacity of the mill will be raised to 1,900 tons per day, and that a slightly improved extraction will be obtained owing to the increased agitation provided."

The average number of men employed by Hollinger Gold Mines, Ltd., during 1915 has been 735, starting with 698 at the commencement of the year, and ending with 685. The men were engaged upon the following classes of work:

Miners—Exploration, 5; development, 83; production, 315.

Mechanics—Operating, 32; maintenance, 78; construction, 84.

Millmen, 98; refinery, 5; engineering staff, 10; clerical staff, 8; miscellaneous, 17.

The following table shows the distribution of milling costs of the Hollinger for 1915:—

Account.	Labor.	Stores.	Totals.	Per ton of ore milled.
General milling charges	\$7,115.83	\$8,662.16	\$15,777.99	\$0.036
Superintendence	10,183.89	.....	10,183.89	.023
Tailings disposal	3,364.23	2,356.81	5,721.04	.013
Lighting	263.54	2,781.30	3,044.84	.007
Heating	1,594.35	8,200.72	9,795.07	.022
Shoveling in bins	3,444.55	.....	3,444.55	.008
Crushing	14,124.04	13,038.12	27,162.16	.062
Conveying	10,659.67	8,484.97	19,144.64	.043
Stamping	13,906.04	34,669.22	48,575.26	.110
Classification and tube milling..	11,142.92	77,709.27	88,852.19	.202
Concentration	10,662.40	4,821.65	15,484.05	.035
Handling concentrates	1,389.89	1,763.40	3,153.29	.007
Treating concentrates	1,231.21	1,246.66	2,477.87	.006
Handling pulp	4,621.18	6,420.08	11,041.26	.025
Thickening	2,471.40	1,803.66	4,275.06	.009
Agitation & continuous decantation	8,055.10	2,258.76	10,313.86	.023
Filtration	10,082.30	10,037.87	20,120.17	.046
Neutralizing	1,334.33	4,533.17	5,867.50	.013
Clarifying and precipitation	2,796.04	29,283.96	32,080.00	.073
Refining	6,584.66	11,304.81	17,889.47	.041
Pumping solutions	5,168.51	6,211.36	11,379.87	.026
Cyanide	6.92	63,352.18	63,359.10	.144
Cleaning mill	6,245.94	.....	6,245.94	.014
Alterations	5,337.98	4,386.53	9,724.51	.022
Assaying	3,067.82	1,825.57	4,893.39	.011
Maintenance of buildings.....	474.39	147.31	621.70	.001
	\$145,329.13	\$305,299.54	\$450,628.67	\$1.022
Less cost of treating 106,486 tons Acme ore			116,079.21	1.090
Cost on 334,750 tons Hollinger Ore			\$334,549.46	\$0.999

GILLIES LIMIT.

The following is a copy of an Order-in-Council approved by His Honor the Lieutenant-Governor the 10th day of May, A.D. 1916.

Upon the recommendation of the Honorable the Minister of Lands, Forests and Mines, the Committee of Council advise that those portions of the Gillies Timber Limit on the Montreal River, hereinafter described, being lands of the Crown heretofore withdrawn from prospecting and disposal for mining purposes be on and after the first day of June, 1916, reopened for prospecting and staking out and sale or lease under the Mining Act of Ontario, and further that the said lands be added to and form part of the Temiskaming Mining Division, such lands being described as follows:

Being all those portions of the said Gillies Timber Limit still in the Crown, bounded on the south by the south limit of Block No. 58; on the east by the east limits of Blocks Nos. 58, 48, 37, 27, 19 and 11 and the

Montreal River; on the north by the Montreal River and the Township of Coleman; on the west and south west by the Town of Latchford, and the right of way of the Timiskaming and Northern Ontario Railway, as shown on plan of survey by J. H. Smith, O. L. S., dated November 25th, 1908, of record in the Department of Lands, Forests and Mines, said portions being more particularly enumerated and described as follows, that is to say:

That part of Block 4 south-west of the Montreal River; part of Block 5 lying south-west of the Montreal River; Blocks 11, 12, 13, 19, 20, 21, 27, 28, part of Block 29, Block 37, part of Block 38, part of Block 39, Block 48, parts of Blocks 49, 58 and 59, having a total area of 7,932 acres, more or less.

Reserving therefrom a road allowance one chain in perpendicular width along the right bank of the Montreal River through Blocks Nos. 4 and 5.

PLACER GOLD MINING IN BRITISH COLUMBIA

By E. Jacobs

The estimate of the Provincial Mineralogist of British Columbia of the value of placer gold received in that province last year, as shown in the recently issued "Preliminary Review and Estimate of Mineral Production, 1915," makes it appear that there was an increase of \$180,000 as compared with the total for 1914. Further, the 1915 total is larger than that of any other year since 1907, which fact has occasioned some favorable newspaper comment in the province.

The commencement of production of placer gold in British Columbia dates back to 1858, for which year a yield valued at \$705,000 is on official record. The maximum production of any one year was that of 1863, with a recorded value of \$3,913,563, followed in 1864 by a total of \$3,735,850, and in 1865 by \$3,491,205. The only other year in which production exceeded \$3,000,000 in value was 1868, when the total was \$3,372,972. Placer-gold mining was at its best in the province during the period 1860-68; thereafter the value of the production of any single year only once exceeded a total of \$2,000,000, and that was in 1875, when Cassiar district contributed substantially to the total of \$2,474,004, which was the value of the yield for that year. The decrease in production was gradual until the early eighties, and after that rapid until, in 1893, the minimum total of production in any year during the history of placer-gold mining in the province was reached, with an output for that year of only \$356,131. Thenceforward there was a steady increase for half-a-dozen years, to which Atlin district contributed materially in 1899, in which year the yield was valued at \$1,344,900. Production was fairly well maintained until 1905; then followed a decreasing annual yield. The total for 1911 was only \$426,000. Since then the annual output has been greater, having reached \$745,000 in 1915, while present prospects are that further improvement will be experienced this year.

During the years 1858 to 1915, inclusive, the aggregate value of the placer-gold recovered is stated in official records to have been \$74,014,603. The production in short periods is shown in the following table:

For eight years, 1858-1865.....	\$21,012,252
For ten years, 1866-1875.....	20,662,663
For ten years, 1876-1885.....	11,218,896
For ten years, 1886-1895.....	5,366,116
For ten years, 1896-1905.....	9,512,776
For ten years, 1906-1915.....	6,241,900

Aggregate value of placer-gold.. \$74,014,603

In connection with the expectation that placer-gold mining may again become of considerable importance in British Columbia, it has lately been again pointed out that such an expectation is quite a reasonable one, for it is known that, as stated in a leading provincial newspaper, "there is a vast auriferous area in the province concerning which practically nothing is known."

In the "Annual Report of the Minister of Mines, 1902," the Provincial Mineralogist gives much information relative to the placer-gold estimated to be contained in "the great low-grade gravel deposits, which have received their chief development about Quesnel Forks, Cariboo district." He said in part:

"Mr. John B. Hobson claims for his company that he has leases of 500,000,000 cubic yards of auriferous

gravels, and it is quite safe to say that he has not in those leases one-fifth of the available gravels, so that in this section alone there must be from 2,500,000,000 to 3,000,000,000 cubic yards of auriferous gravels, which there is every reason to think will be as rich as the Consolidated Cariboo Company's deposit. The immensity of these figures is hard to grasp, but to illustrate—if ten cubic yards yield \$1 in gold, then there is in the Quesnel section alone \$300,000,000 worth of gold. This vast amount of gold is so 'diluted' with sand and gravel that the only possible means of extracting it is by the use of immense volumes of water under pressure, in other words, by hydraulic mining."

Placer-Gold Mining in 1915.

In the "Preliminary Review," above-mentioned, the Provincial Mineralogist makes the following comment:

Placer Gold.—The estimated recovery of placer gold for 1915 is \$745,000, of which practically all is obtained in the Cariboo and Cassiar districts, only about one-tenth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo district, \$312,000; Atlin division of Cassiar district, \$355,000; Stikine and Liard, \$30,000; remaining parts of the province, \$48,000. It may be that a larger yield will be shown, but this cannot be definitely stated until after the final returns of the season's operations shall have been received.

The output of placer gold is larger this year than it has been since 1907, and will probably be about \$180,000 greater than that of last year. This comes as an agreeable surprise, for the snowfall of the winter of 1914-15 was unusually light, and, as this is the principal source of the water-supply, it was expected that the quantity of water available for hydraulicking would fall short of the usual quota.

In hydraulic mining it has been pretty well demonstrated that the gold output is in direct proportion to the number of days in which water was available for piping, hence there seemed little hope for even a normal production of placer gold during the season of 1915.

The Weather Bureau, however, as though in compensation for the niggardly amount of snow provided, so arranged the spring weather that the snow melted very gradually—not much faster than the water could be used—while the absence of spring freshets prevented the great waste of water usual at such times. Subsequent summer rains in Cariboo district also very much assisted in keeping up the water supply.

The shortage of work general throughout the province during the early summer caused a greatly increased number of men, both whites and Chinese, to undertake small placer operations; this was particularly noticeable in the districts adjacent to Quesnel and Quesnel Forks.

During the summer months the unusually low water exposed bars on the Fraser and Thompson rivers which are seldom accessible, and these were worked in numerous places by Indians and Chinese, with good results.

In the Barkerville section of the Cariboo district the larger hydraulic companies made a greater output than usual, while an increased number of individuals appear to have been working in a small way; this is also true of the Quesnel and Quesnel Forks sections,

which report much larger amounts of gold recovered than has been the rule for some years past.

This is accounted for by the general shortage of other work throughout the northern part of the province, which caused many men to once more take up placer-mining, even if it only produced wages.

No authentic news has as yet been received from the Omineca district, where considerable work has been going on, most of which, however, is of a preparatory nature, and it is not expected that any great output has been made this year, probably not more than about \$12,000 all told.

In the Atlin district the shortage of water was very noticeable, some of the companies being so short as to be only able to work effectively for half the season. On the other hand, some of the companies were evidently working in richer ground; it is not known whether this was by good luck or by intentionally attacking only the richer parts, in an attempt to compensate for the water shortage.

Very little summer rain fell and its absence was much felt during the latter part of the season. Notwithstanding these drawbacks, it would appear that a somewhat increased production was made in this district.

In the Liard-Stikine district the Boulder Creek Hydraulic Mining Company had a successful season, taking out about \$20,000 from its ground on Thibert creek Ball and Finn and Mitchell Bros., working in the same vicinity, made small outputs.

Four different partnerships were at work on Dease creek, with success enough to at least pay wages.

Some gold was taken out of the Tahltan river by Indians and others working in the river-bed.

It is to be noted that two or three parties were working down the Liard river, at McDame creek, and on Rosella creek, a section that has been practically abandoned of late years.

The Similkameen and Tulameen rivers produced more gold in 1915 than for some years back and give promise of again being a factor in the placer-gold industry.

Vernon district also yielded some gold from hydraulic operations in Siwash creek.

Yale mining division made an unusually good output, owing to the very low water in the rivers exposing the bars.

The Fort Steele mining division made a better output than for some years past.

CARIBOO DISTRICT.

Three mining divisions are usually included under the general head of Cariboo district—namely, the Cariboo, Quesnel, and Omineca divisions. In the first two divisions mining operations are restricted almost entirely to placer-mining, there being little, if any, other productive mining, but in the Omineca division lode-mining is now more important, due to the advent of railway facilities in the southern portion of the division.

The conditions affecting placer-gold mining in this district have already been referred to under the sub-head of "Placer Gold," and, while the conditions were not particularly favorable this past season, it would appear that the gold-output was materially larger than it had been for some years past.

Quesnel Mining Division.

The hydraulic properties operated by Mr. John Hopp, which include Stouts Gulch, Lowhee, and Mosquito Creek are reported to have done exceedingly well this past year, better than ever before.

Loo Gee Wing's Point claim, on Slough creek, was operated under the management of Joseph Wendle, and is reported to have taken out more gold than in any previous year, thus justifying the more up-to-date equipment installed in 1914.

The company's water-storage facilities are not as good as might be desired, so that the melting of the snow gradually, as it did last season, was a very material assistance.

No information has been received regarding the Lightning Creek Hydraulic, and it is believed the property made no serious output; the manager, Mr. Bonner, has been out of the country all the season.

Cariboo Mining Division.

In the Quesnel division none of the larger companies that formerly made large outputs worked last season.

The old Hobson property at Bullion, which has been the subject of disputed ownership for a couple of years, was prospected last season by one of the claimants—Mr. Ward. Since then the stakings of John Hopp et al, have been recognized by the Government, and the chances are that next season will see the property working again.

In the vicinity of Quesnel and around Quesnel Forks an unusually large number of individual miners have been working in a small way, and the bank at Quesnel reports having bought nearly \$80,000 worth of gold in small lots.

About the usual amount of work was carried on around Keithley creek, but no large amount of gold was taken out.

During the season there was a stampede into Swamp river, which flows southward into Cariboo lake; subsequent investigation, however, did not confirm reports brought out by the first prospectors and the excitement died away.

Omineca Mining Division.

Placer-mining is not now very important in the Omineca mining division, the production for last year being estimated at about \$12,000.

In the Omineca River region, so far as is known, only one placer-mining company was working. This was the Kildare Mines, Limited, on Slate creek, which employed 33 men during the season, presumably mainly on development work.

The Cassiar Hydraulic Mining Company, Limited, on Kleanza creek, also carried on operations with 17 men and made a small clean-up.

On Lorne creek the Dry Hill Hydraulic Mining Company continued work with 23 men, and it is supposed the erection of a long flume-line was proceeded with.

CASSIAR DISTRICT.

The extensive area known as Cassiar district includes the following mining divisions: Atlin, Liard, Stikine, Skeena, Queen Charlotte, and Portland Canal.

(There is little, if any, placer-mining done in the latter three divisions.—Ed.)

Atlin Mining Division.

The Atlin district during 1915 maintained the rank which it has enjoyed for some years past as the chief producer of placer gold in the province, and is estimated to have produced \$355,000 worth of gold, which represents about 47.7 per cent. of the provincial output.

Pine Creek.—The Pine Creek Power Company—a company organized and operated some years past by Mr. J. M. Ruffner—was the largest operator on this creek during the past season; the mining was chiefly

confined to hydraulicking on the ground known as the Guggenheim claims on Tar flats, which the Pine Creek Power Company has been working for some years back on a lease from the owners. Mr. Ruffner, who was the organizer of the company and manager since its incorporation, retired during the season of 1914, and was succeeded by Mr. Frank Breeze, formerly book-keeper and assistant to his predecessor, who continued in the management during 1915.

Moshannon and Besbrook worked some 31 men throughout the season, but no details of the work done, nor of the amount of gold recovered, have as yet been received.

Three or four properties on this creek were very profitably worked by "laymen."

Spruce Creek would appear to have been one of the busiest creeks in the division this past season, and is credited with an output of gold approximating \$110,000, produced by some 23 companies or partnerships. Of this, the largest contribution came from the Joker and Poker leases, worked by 38 "laymen," followed, in order of importance of output, by the Gladstone lease, the Chicago Bill, Peterboro', Bloomfontein, Hard-scrabble, and Polar Star.

Boulder Creek saw seven small properties being worked by the owners or "laymen," with fair success in a small way.

Ruby Creek.—Three concerns operated here throughout the season, the chief operations being on the Rose, where some 17 men were at work and are expected to have produced nearly \$70,000.

McKee Creek.—The Delta Gold Mining Company operated on this creek during the season, employing about 18 men and taking out, it is estimated, approximately \$35,000 in gold. No particulars of the work done have yet been received.

Birch, Otter, and Wright Creeks.—On Birch creek three properties were worked—the Romance, Forks, and Long Walk—employing eight or ten men and producing somewhere about \$10,000 in gold. On Otter creek nine men were at work on the London, chiefly on preparatory work, while five men were at work hydraulicking on the Raven with fair results. On Wright creek hydraulicking was carried on by four men on the Jasper lease, while the Southern Cross claim was worked by the owner. No returns have as yet been received as to the results of the work.

Various Creeks.—A couple of leases on Volcanic creek were prospected and one on Graham creek, but no returns have been received from them.

On Rose creek two claims were worked by the owners, and on Wilson creek three claims.

On Gold Run two properties were worked by "laymen," who were drifting.

On Bull creek a number of leases were prospected, but with what result is not yet known.

O'Donnell River.—The O'Donnell Placer Company operated on this stream drifting and hydraulicking, employing some 15 men, but, as far as can be learned, with anything but satisfactory returns this season. Prescott and partners—some five men in all—worked one of the Gold Hill leases, taking out a fair amount of gold. Some seven or eight individual miners also worked on their leases, but no returns were received from them.

Stikine and Liard Mining Divisions.

Mining in the Stikine and Liard divisions consists entirely of placer-mining, and most of this is within

the boundary of the latter division. On the Tahltan river, in Stikine, Indians worked the bars for a short time, but with indifferent success.

In the Liard division the principal placer operations are carried on by the Boulder Creek Mining Company, which operates an hydraulic plant on Thibert creek. Owing to the extremely dry summer, this company was held back considerably by a shortage of water, only getting in 29 days' work during August, September, and October. Richer ground than usual must have been worked, as the output for the season was about the same as in the previous year.

Ball and Finn, drifting about a mile above the Boulder Creek Company's property, struck ground which was fairly rich in coarse gold, but spotted, and while their progress was slow on account of boulders encountered, still they managed to make a grub-stake.

Mitchell Bros. did some prospecting on Deloire creek and also Adsit and Calvert on Mosquito creek.

On Dease creek four small operators were at work, but the returns were not very large. Two outfits were at work on McDame creek, merely engaged in prospecting.

Nothing further has been heard regarding the drilling operations on the flats at the mouth of Dease creek.

The production for the division is estimated at \$30,000.

LA ROSE.

The ninth annual report of the La Rose Consolidated Mines Co. shows combined surplus of holding and operating companies at the end of the year at \$937,490.

President D. L. McGibbon says: Exploration and development work have been continuously carried on during the year. Several properties were examined and two are still under examination, on which options have been acquired.

Results of 1915 operations compare with previous years as follows:

	1915.	1914.
Net selling prize per oz (cents)	50.88	53.92
Production silver, oz.	1,135,142	1,368,247
Net value	\$526,996	\$637,555
Cost production per oz. (cents)	31.64	37.2
Net profit	\$230,662	\$217,979
Dividends	299,725	749,313
Surplus	937,490	1,040,380

A year ago the total silver in sight under ground and in the dumps was estimated at 860,000 oz. During the year the production amounted to 1,135,000 oz. The only high grade ore in sight at present is a small amount contained in pillars in the La Rose mine; but in the extraction of this ore and in the general cleaning up of the mine, it is probable that other small bodies will be discovered.

The mill ore, of which there was 44,000 tons at the beginning of the year, has been reduced to about 10,000 tons. In addition to this, there are certain portions of the dumps which, while lower grade, may yield a small profit.

The net profit of \$230,662 for 1915 year is considerably better than was anticipated a year ago. On a smaller production the profit was larger than in the previous year, and the cost per oz. was less. This larger proportion of profit was because of less money spent in exploration.

The price of silver went as low as 46¼ cents per oz., and the average received during the year was only 50.88 cents—the lowest record in the company's history.

MINING ENTERPRISES IN CANADA*

By Mr. J. B. Tyrrell.

It is difficult for most men living in cities or thickly populated centres, not only in Great Britain but in Canada itself, to realize the vast extent and possibilities of that country. A journey in a railway carriage across its southern portion from Montreal to Vancouver may give the traveller who will use his eyes a glimpse of its vastness, but it is only a glimpse of the most settled and thoroughly explored areas where its natural resources are being actively developed and used. Country similar to that seen extends for a thousand miles or more beyond the horizon, and holds potential wealth of many kinds waiting to be discovered and utilized—I sincerely hope by people of our own race. The Dominion of Canada has a length from east to west of about 3,500 miles, a width from south to north of about 1,400 miles, and an area of 3,729,665 miles, which is about twenty times the total area of the British Isles. At the present time it has a population of, roughly, 8,000,000 people, about the same number as the population of England at the beginning of the last century.

The early settlers of Canada, both French and British, were agriculturists who settled on the rich farming land beside the navigable lakes and streams that formed the only highways through the country, though in the wilderness beyond there were vast areas of similar rich land which at the time could not be reached. Later on highways and railways were built through or near the more settled parts of the country and between the Great Lakes, but people did not seriously begin to move into the great interior country until about 1884, when the northern part of the Province of Ontario and the Provinces of Manitoba, Saskatchewan, Alberta and British Columbia were rendered accessible by the building of the Canadian Pacific Railway from Montreal along the north shore of Lake Superior and across the plains and mountains to Vancouver. Up to this time the attention of the people had been occupied with agriculture, forestry and fishing, and but little thought and energy had been devoted to mining. In 1886, the first year in which an accurate official report on the mineral production of the Dominion was compiled and issued, the total output of useful minerals of all kinds, metallic and non-metallic, had a value of only £2,100,000, or 9s per head of the population.

The building of the Canadian Pacific Railway opened a new era in mining in Canada. It furnished means of easy access to a new and previously inaccessible country; it opened up new mining districts, and in a rock-cutting on the railway itself there was exposed for the first time the vast nickel deposit near Sudbury. A new interest in mining was stimulated, and as a result the mineral production rose in 1890 to a value of £3,450,000, or at the rate of 14s per head of population. During the next five-year period development and production progressed slowly but steadily, and in 1895 the output of the country had reached a value of £4,200,000. In the following year the gold-bearing placers of the Klondike district were discovered, and by 1900 the mineral output of Canada had jumped to £13,250,000, or 50s per head of population. In five years the mineral production of the country had been trebled. About one-half of this increase, or a third of the total production, was derived from the gold of the

Klondike, but the other half of the increase was attributable to a general development of the mineral resources of the whole country, and to the keen interest which the people were taking in all mining enterprises. After 1900 the production of the placer mines of the Klondike began to decline, and by 1905 it had decreased from £4,600,000 to £1,600,000 a year, but not withstanding such a heavy drop in the output of that extraordinary camp in far Northern Canada, mining had been so active throughout the Dominion that the total mineral production had nevertheless increased to a value of £14,200,000 a year.

Shortly before the close of this last five-year period a new silver-bearing field had been discovered in a rock-cutting on a new railway line in the midst of the pine forests of Northern Ontario, but as yet its influence had been only slightly felt on the statistics of the mineral production of the whole country. The centre of this district is now the town of Cobalt, and up to the end of December last it had produced 234,000,000 ozs. of silver, and is still going strong. Considering the richness of its silver-bearing veins, and the small area of country in which these veins are distributed, the Cobalt district is undoubtedly one of the richest silver-producing areas in the world.

In 1910, at the end of the succeeding five-year period Canada's annual mineral production had increased by £7,800,000 to a total of £22,000,000; £3,000,000 of this increase was due to the output of silver from Cobalt, while £4,800,000 was due to a general acceleration of mining activity throughout the whole country from the Atlantic to the Pacific. During the five years just past the mining industry has been making steady progress, and in the year 1915 Canada yielded mineral wealth to the value of £28,500,000, or 74s per head of the population, consisting of metallic products of the value of £16,000,000; chiefly nickel, gold, copper and silver, in the order here given, and non-metallic products of the value of £12,500,000, somewhat more than half of which was coal. The average annual increment of increase in mineral productions for ten years from 1905 to 1915 has been £1,400,000. I have presented these figures as evidence of Canada's steady and uninterrupted growth in mineral production, but, at the same time, I would emphasize the fact that as yet its population is small, and is distributed somewhat irregularly near its southern border. Most of the knowledge possessed of the country has been acquired by people who live in that southern border region, and the great part of such knowledge refers to the border region itself or to the country immediately contiguous to it.

Within or near this southern border are the great nickel mines of Sudbury—the chief source of the nickel supply of the world; the silver mines of Cobalt—the richest individual silver-bearing area in the world; the gold mines of Porcupine, which are making good their original promise of great wealth; the copper mines of Quebec, and most of those of British Columbia; the asbestos mines of Quebec, where most of the asbestos of the world comes from; and the great coalfields of Alberta, which have recently been shown by officials of the Canadian Government to be among the largest coalfields in the world.

*From report of meeting of Anglo-French Exploration Co., London April 28, 1916.

Beyond the populated and partly-developed southern border land is a vast area, which is still untenanted and unprospected. The means of transportation into it are imperfect, and no local supplies of food are available, so that even if men should penetrate into it they would be unable to live and work in it until they could obtain a regular supply of provisions from the settled country to the south, which they might supplement later by clearing the land of its forest growth and raising provisions for themselves. But transportation facilities are being gradually improved all the time, and with these improvements the men who are scattered along the borders of civilization, and have begun the development of the country behind them, continue to push on farther into the wilderness.

In this way, through the enterprise of restless but experienced men, inured to every kind of hardship, the unknown lands are explored and prospected, while the fuller development of the mineral and other resources of the country behind them is left to others drawn from the larger centres of civilization.

The three processes of discovery, development and production have been going on steadily for a generation, and as more men are being trained for the work from year to year, and since the natural conditions for discovery are favorable, development and production will undoubtedly continue in increasing ratio for generations to come. The useful minerals and metals of Canada have already added largely to its wealth, and incidentally to the wealth of many of those who have assisted in extracting them from the earth and converting them to the uses of mankind, and there is no doubt but that in the future, as in the past, they will continue to yield wealth to those who take an active and intelligent interest in them.

In the reorganization of the resources of the Empire which is certain to take place after the war this wealth taken from Nature's storehouse should be secured as far as possible by citizens and supporters of the Empire, and I trust that the name of the Anglo-French Exploration Company, combining as it does the names of two of the greatest of the Allies who are fighting the battles of civilization against primeval barbarism and brutality, will occupy an honored place in the list of Nature's beneficiaries.

MR. N. A. TIMMINS ON HOLLINGER MERGER.

In his report to shareholders President N. A. Timmins said: "Those of our shareholders who have followed the history of the Porcupine camp from its earliest days are aware that, in addition to the four Hollinger claims, containing 160 acres, the Syndicate now represented by Canadian Mining & Finance Co., Limited, about the same time purchased a number of adjacent properties and that, of these other properties, three claims, containing 120 acres, were transferred to Acme Gold Mines, Limited, that three other claims, containing 120 acres, were transferred to Millerton Gold Mines, Limited, and that Mining Claim No. 13147, containing 40 acres, was transferred to the Finance Company. Adding the Hollinger acreage to these other claims, we have an almost solid rectangular block of about 440 acres as the area to be taken into the consolidation.

"Under the original plans provision was thus made for carrying on operations on the various claims by separate companies, but it soon became apparent that joint operation at least, if not actual consolidation, would eventually prove the most satisfactory and economical method of dealing with the properties. The

final disposition to be made of the properties could not, however, be definitely and satisfactorily settled until a great amount of experimental work had been done and many complicated investigations made. The extent and character of the ore bodies, as well as the grade of the ore, had to be determined, and various mining and metallurgical problems remained to be solved. We, therefore, decided at a comparatively early stage of our operations, to keep in view the consolidation of the properties, and each step in the design and building of the plant and in the planning and carrying out of underground development work was taken with this possibility in view. We also determined to proceed with all due caution until the situation as a whole had been thoroughly worked out and until we were able to place before the shareholders of the Hollinger Company such a scheme as would readily commend itself to all interested parties. Our unique position as owners of all the other claims involved in the consolidation, and as largely interested shareholders in Hollinger Gold Mines, Limited, made it possible for us to give the subject the consideration its importance demanded, and to work out well considered and mature plans without regard to the pressure exerted from time to time to hasten our action.

"The extensive development work on the Acme claims and the increased mining and milling operations on the Hollinger properties have recently rendered it imperative to take action and to settle the question of consolidation. In fact we have reached such a stage in the operations of all the companies concerned and in the various mining and milling problems to be faced that any further delay might have a tendency to prevent consolidation. As shareholders of the company, you are fully aware of the thorough and painstaking methods of our General Manager in the conduct of the company's operations, and we can assure you that he has given to this Special Report and to the plans and details of consolidation the very best consideration possible.

"In our opinion the special plan to be submitted provides for consolidation of the various properties upon an equitable basis to all concerned, and it will, we feel sure, result in great advantage to all shareholders. As owners of the other properties involved, we feel that we are making substantial concessions in including a large block of unprospected territory at a nominal valuation, but we do so in full recognition of the fact that if there is to be any advantage in the transaction it must be given to the present shareholders of the Hollinger Company.

PETERSON LAKE.

Cobalt, May 20.—In a crosscut from the 50-foot level of the Reliance property, under option to the Peterson Lake Mining Co., a vein was cut this week. The vein is of calcite showing some specks of mineral but no silver. The crosscut was run to the southwest from the shaft and the vein was located about 85 feet from the shaft. The crosscut, it is expected, will be continued a few yards further, after a few rounds have been taken out in drifting on the vein.—Cobalt Nugget.

MINING ENGINEERS WANTED.

The War Office has asked for 50 mining engineers to enlist for special service. Applicants should be prepared to go overseas at short notice and train. They will be given commissions in the Canadian Engineers.

PERSONAL AND GENERAL

Commissioner Black, of Dawson, Yukon Territory, was operated on for appendicitis at the Royal Jubilee Hospital, Victoria, B.C., on May 4.

Mr. Raleigh P. Trimble, of Portland, Oregon, for several years actively interested in developing mining property on Rocher Deboile mountain, Omineca mining division of British Columbia, has returned to that part of the province to direct operations on the Cassiar Crown Copper Co.'s mineral claims, after having been on a business trip to Oatman mining camp, Arizona.

Mr. B. Mattingly, who was with the Tonopah-Belmont Co. in Nevada, is now at the Surf Inlet gold mine, on Princess Royal Island, British Columbia, where the Tonopah-Belmont Development Co. has been doing development work for nearly two years.

Mr. Harry W. Newton, who was on the Northport Smelting and Refining Co.'s staff some years ago, and since then did valuable metallurgical work in Republic camp, Washington, is now metallurgist and assayer for the Norman Mines Co., of Spokane, Washington, operating in the neighborhood of Northport, also in that State, and a few miles south of the International Boundary line and the south-eastern corner of Trail Creek mining division.

Dr. Willet G. Miller returned to Toronto on May 14th from a three-months' trip to England and France, and sails from San Francisco with T. F. Sutherland on May 23rd for Australia and New Caledonia.

Mr. W. E. Simpson is developing a molybdenite property near Amos, Quebec.

Mr. I. D. D. Dainpre, of Sudbury, is in Toronto.

Mr. R. E. Hore has returned to Toronto, after visiting Cobalt silver mines.

Siemens Co. of Canada, Ltd., 120 St. James Street, Montreal, have recently supplied a 470 H.P. electric hoist for the Mond Nickel Co., Ltd., Comiston, Ont. Also two 280 H.P. motors for driving air compressors at Acadia Coal Co., Ltd., Stellarton, N.S.

The Roberts and Schaefer Company, engineers and contractors, Chicago, have closed a contract for a horizontal screen and tippie equipment to be installed immediately for the Rose-Deer Coal Mining Company at Wayne, Alberta.

Mr. W. M. Brewer, of Victoria, will spend the greater part of the field season of this year investigating metal-mining conditions and obtaining information relative to metalliferous mining properties on Vancouver Island for the British Columbia Department of Mines.

Mr. E. V. Buckley, manager for the Queen Mine, Inc., at Sheep Creek, Nelson mining division of British Columbia, was in Spokane, Washington, recently to meet and confer with the president of the company, who came from Wisconsin. The Nelson Daily News states that an option of purchase of the Queen gold mine at the price of \$300,000 has been obtained by Mr. J. R. Rutherford, for some time general manager for the Motherlode Sheep Creek Mining Co., who is acting for the Tonopah-Belmont Company, which about six months ago took up its option to purchase for \$150,000 an 80-per cent. interest in the Surf Inlet Gold Mines, on Princess Royal Island, B.C.

Mr. Albert Dunn is superintendent for the Highland Valley Mining and Development Co., which is developing mineral claims in Highland Valley, in Ashcroft mining division of British Columbia.

Mr. A. C. Flumerfelt, of Victoria, B.C., has been re-elected president of the International Coal and Coke Co., operating a coal mine and coke ovens at Coleman,

south-west Alberta, with Mr. O. E. S. Whiteside as general manager.

Mr. Thomas Graham, chief inspector of mines for British Columbia, will shortly leave Victoria on a visit to Joplin, Missouri, where he will attend the annual meeting of the Mine Inspectors' Institute of America, of which he has been first vice-president for the year now closing.

Mr. A. B. W. Hodges, after having spent the winter at Honolulu, Hawaiian Islands, arranged to leave there for San Francisco on May 3. It was his intention to motor from the latter city to Los Angeles, Southern California, where he now has his home.

Mr. Frederic Keffer, of Spokane, Washington, spent the latter part of April at the Highland Valley Co.'s mine, Ashcroft, B.C., and early in May was in Victoria on his way home.

Lieut. O. E. LeRoy, of the Western Universities Battalion, was in Victoria, B.C., lately, attending one of the classes for the instruction of military officers in special subjects.

Mr. J. R. Lockard, of Cumberland, Vancouver Island, B.C., left that town early in May on a business visit to New York city. He is general superintendent for the Canadian Collieries (Dunsmuir) Limited, which operates several coal mines of its Comox colliery near Cumberland, and other mines, of its Extension colliery, near Ladysmith, also on the Island.

Mr. A. W. McCune, of Salt Lake City, Utah, is again in Ainsworth district of British Columbia, where he intends doing development work on one of his mining properties, situated within a few miles of the town of Ainsworth.

Mr. I. L. Merrill, of Los Angeles, California, president of the Hedley Gold Mining Co., was at Hedley, Similkameen, B.C., early in May, and while there agreed to grant an increase of 75c. a day to underground men and 50c. a day to surface men in the company's employ.

Mr. J. E. Oppenheimer, of Butte, Montana, who was at the head of the Montana Continental Development Co. that for three years operated under lease the Rocher Deboile copper mine, situated in the Hazelton region, Omineca mining division, British Columbia, has returned to that district to attend to other mining matters in which he is interested.

Mr. J. J. Warren, of Toronto, managing director for the Consolidated Mining and Smelting Co., a few weeks ago paid a visit to the company's smelting and refining works at Trail, B.C.

Thirty students and instructors from the College of Mines, University of Washington, Seattle, State of Washington, took part in the annual spring excursion in April. Studies were made of the new reverberatory and casting furnaces at the Tacoma smelting works, and the Dupont Powder Works, on Puget Sound, and of the mine and concentrating mills of the Britannia Mining and Smelting Co., on Howe Sound, Vancouver mining division of British Columbia. The Britannia Company is using Hancock jigs, Butchart tables and Minerals Separation flotation cells, to make a high recovery from low-grade chalcopryrite ore.

Mr. G. O. Buchanan, formerly of Kaslo, but now resident at Haney, on lower Fraser River, B.C., who for some years has been Dominion Supervisor of Lead Bounties, has been elected the first president of the recently-organized Associated Boards of Trade of British Columbia. For several years he did most effective work as president of the Associated Boards of Trade of South-eastern British Columbia.

SPECIAL CORRESPONDENCE

COBALT

Price of Silver.

The price of silver has been well maintained, although there has been a slight reaction during the last week. This was to be anticipated and there is every confidence that silver will not go below seventy cents. It has remained steady during the past week around seventy-five cents and it is quite possible there may be no further advance until information is received that silver stocks have again run low in the markets of the world.

Columbus.

Another prospect which has been shut down for some time is being reopened. The Columbus has had many starts. It was running when the Temiskaming first struck high grade in south-east Coleman, and it has been shut down and opened up again three or four times since. Quite extensive development has been carried out from two shafts, as low as the 400-ft. level, but nothing has ever been found to date, but a wide vein of galena, with low silver content. It is now being reopened under the management of Mr. William Donaldson. The company has no doubt been encouraged to take a further chance, by reason of the successful development of its neighbor the Adanac.

Advance.

Two winzes have been sunk on the Adanac from the 200-ft. level. One of these struck ore and ran out of it again and is now being continued to 350 ft. From another, a sub-level was run at 280 ft. and there is some high grade in sight now.

Gifford.

The Gifford is still laboring under water difficulties. The unexpected flow of water is holding up development and some arrangements will have to be made with adjoining properties, before active work can be prosecuted with much success.

Beaver and Temiskaming.

The progress of work in the shafts of the Beaver and Temiskaming is being closely watched by the whole camp. It is recognized that here, if anywhere in the camp, is there a hope of extending the life of the district as a silver producer. The shaft on the Beaver is further down than that at the Temiskaming. It is now between 1,500 and 1,600 ft. deep and only lacks 100 ft. of reaching the point where the diamond drill showed it could be expected that the lower contact would be reached. The Temiskaming shaft is down between 1,100 and 1,200 ft. It is not expected that any orebodies can be picked up in the lower contact without much cross-cutting and development, but that they do exist is hoped, as a consequence of successful operations on the same horizon by the Kerr Lake and O'Brien.

National Mines.

The National Mines with a lease on the old King Edward are also prosecuting deep level mining. There is also a prospect that this same company may install oil flotation cells to treat the old King Edward tailings, which were known to run high. Diamond drilling some years ago showed that the lower contact here might be reached at about 1,000 ft. The shaft is now down at 550 ft., so that it will be well into the fall before any definite results may be anticipated.

South Lorrain.

The next month or six weeks should witness the resumption of ore shipments from the South Lorrain camp. The Bellellen has assembled a car of 25 tons of ore, including some high grade and some medium grade ore. The Comfort Leasing and Mining Company has also taken out some high grade from the Wettlaufer. Prospects for both companies producing further ore are very bright. There have been no shipments from the South Lorrain camp since the Wettlaufer Mining Company sent its last car out in 1914. The Bellellen only made one shipment previously and that was of 13 tons of high grade ore in 1911.

Oil Flotation.

The oil flotation plant at the McKinley-Darragh is all ready and now awaits the arrival of the press. It will be the first oil flotation plant in the camp which has operated in regular practice. The Buffalo work was largely experimental, and so is the Nipissing's. There are half a dozen other companies in the camp waiting until the McKinley-Darragh has obtained some definite results from their operation. Among those companies who may be reasonably expected to install oil flotation are the Trethewey, Hudson Bay, Coniagas. The National Mines and others, but the results obtained by the McKinley-Darragh will very largely influence further installations.

La Rose.

The La Rose Mining Company has closed down its new shaft next to the Chambers-Ferland. They found no encouragement to proceed with their work at this point. A pocket of very rich ore has been found on the Lawson and it is now being developed and stoped out.

Mining Corporation.

The Mining Corporation is developing some remarkable ore on the Cobalt Lake Fault. The vein here is sometimes 18 in. wide of very high grade silver indeed.

Gillies Limit.

Another section of the Gillies Limit is to be thrown open to prospectors on June 1st. This section of the Limit comprises over 7,000 acres and includes much Huronia rock which has come to be regarded as most favorable for the deposition of silver. The claims will be staked out in 40 acre claims. The block to be thrown open on the midnight of May the 31st, is bounded on the north by the Township of Coleman, on the east by the Montreal River and the T. & N. O. Railway and on the south by Johnny Lake and Johnston's Siding, on the T. & N. O. Railway. Owing to the large number of prospectors who have gone to the war and the decreasing interest in the possibilities of the Gillies Limit, there will be no such rush to stake as occurred two or three years ago, when the last section of the Limit was thrown open, but the high price of silver will undoubtedly cause some staking in the Limit and any discovery would lead to a very feverish interest in this hitherto forbidden section of the country.

PORCUPINE, KIRKLAND LAKE AND BOSTON CREEK

McIntyre.

The event of the past two weeks has undoubtedly been the remarkable discoveries on the lower levels of the McIntyre. It has now been made known that 62

ft. of ore averaging better than \$14 was cross-cut on the 700-ft. level. This orebody has been drifted on for not less than 100 ft. At the 1,000-ft. level the long crosscut which is to connect the McIntyre Extension shaft with the No. 5 had cut a vein 25 ft. wide of better than \$15 ore by the middle of the month. It is a remarkable fact that values did not grow to any appreciable extent until the cross-cut was in McIntyre ground. The value of these discoveries is fully appreciated in the camp as the big event since the opening up of the lower level orebodies of the Dome. It has put the McIntyre on a permanent basis as to ore reserves.

The McIntyre mill is now running almost to capacity. After various delays owing to the great difficulty of obtaining delivery of machinery and supplies, the Jupiter shaft is now connected with the McIntyre mill, by means of surface tramway and aerial tramway. Seventy-five tons a day is passing from the shaft to the mill. Quite a good tonnage of ore has already been broken in Jupiter stopes and development is well ahead of mill requirements.

Dome Lake.

Good results are being obtained at the Dome Lake. At the 300-ft. level the No. 1 vein has developed a shoot of high grade ore in a raise about 400 ft. west of the shaft and 14 ft. up. The No. 1 vein at the level is of the usual grade of \$5 or \$6, but on raising about 14 ft. it showed 5 ft. of ore which will run almost \$50 to the ton. Mill heads are being maintained about \$7.50.

West Dome.

The West Dome is experiencing good fortune with its development. This is particularly so in regard to diamond drilling. Below the 500-ft. level an orebody was entered which appears to be at least 5 ft. wide of ore that will run \$45 to the ton. The vein in the shaft is not more than 2½ to 3 ft. wide, but it shows considerable free gold and a good average grade. This company will soon have to order a new plant if they desire to extend their operations, as the better prospects of the property now warrant.

Croesus.

The Croesus Gold Mining Company in Munro Township is down to the 400-ft. level. The mine is producing about \$1,000 a day from raises in ore and development. Ore is broken down on the property and converted into bullion.

Within three miles of the Croesus a very promising discovery has been made on some claims controlled by Mr. C. A. Foster. Very spectacular specimens have been brought out.

Tough-Oakes.

At Kirkland Lake Mr. C. A. O'Connell will take charge of the Tough-Oakes mine at the beginning of June. The mine is looking very well indeed and production is being more than maintained at its last year's average.

La Belle Kirkland.

At the La Belle Kirkland mine at 350 ft. the vein is being drifted on both ways. The high grade streak of ore in the foot-wall is continuous in both drifts and the prospects of the mine are exceedingly good. Further cross-cuts will be undertaken to pick up other streaks of high grade ore shown in the shaft and on the 200-ft. level.

Boston Creek.

At Boston Creek the R. A. P. Syndicate holdings have recently been sampled by Mr. G. C. Bateman and

there will probably be some change in ownership of these properties very soon. The Nissen stamp mill on the Miller Independence is running and some very rich ore is being put through it. The first gold bar from Boston Creek should soon be shipped. Some finds of free gold on other claims in the district are also reported.

NEWFOUNDLAND

Iron.—Both mines at Wabana of the Dominion Iron and Steel Co. and the Nova Scotia Co. are now working full blast, and about two thousand men are now working there. The first cargo of ore to be shipped since navigation opened this spring was taken away this week from the mines of the Dominion Co. to the smelters at Sydney, Nova Scotia. There are now thousands of tons stocked piled on the bank ready for shipment, and it is anticipated that the coming summer will be the busiest in the history of the mines.

Lime Quarry.—The lime quarry of the Dominion Iron and Steel Co. at Port-Au-Port is again working, operations having been started on May 1st. The quarry supplies a large portion of the flux material for the smelting of the company's ore at Sydney.

Last year operations were entirely suspended. Several hundred men are now working there. There is plenty of employment at the quarry and the wages are good. The manager, Mr. House, has during the past and present weeks been active in seeking men to engage at the work. Work is to be carried on uninterruptedly during the season, as enormous stocks of lime are needed for the Sydney smelters, and the Evening Herald states that "everything points to a big boom on the west coast."

Copper.—The Tilt Cove mine which was working all the winter, during which time excellent work was done, has made its first shipment of ore this spring. The cargo was shipped from the mines during the first week of May. The cargo was consigned to New York. Besides the actual mining of the ore there are large piles which were mined before the mine closed down some five years ago, owing to the low price that copper was fetching. All these piles will be shipped away this year.

There are at present at work at the mine between one hundred and fifty and two hundred men. If the price for copper is maintained it is not unlikely that work will be done on a scale in the near future equalling that of the good old days, when Tilt Cove ranked as one of the most productive and finest copper mines in the world.

It is more than probable that the Bob's Head copper property will be worked this summer. This property is located in Notre Dame Bay, within a few miles of Tilt Cove. About seven years ago actual work was done on the property. Two shafts were sunk, one of which was eighty feet and the other was something over fifty. Several trial pits were made and everything indicated that here was a second Tilt Cove. A quantity of ore was mined. Just at the time that the shipping of the ore was about to begin, a decline in price of that commodity discouraged the promoters, and work was discontinued. The stock piles, which are large, will be shipped at an early date.

Engineers from Boston are now on their way to examine the property, and I have been reliably informed that if conditions are favorable, which I know them to be, vigorous operation will be at once commenced. The property is now locally owned, but those who will finance it are Americans.

Coal.—A law suit over the possession of coal areas, which occupied the attention of the Supreme Court for

a period of two years was recently concluded. The case was between a lessee of the areas and the Newfoundland Government. The claims are situated at Robinson's Brook, on the west coast of the country.

The Government claimed that the titles to the areas were not legal, which titles were given in the usual way at the Office of Mines, and over the legality of the titles a fierce suit was carried on. The areas in question are said to be rich in coal, and since the suit has been decided an American Syndicate, it is reported, has made arrangements to have the property opened and worked this summer. The areas in question have been examined and no doubt exists but that this is a valuable deposit. The Government for the sake of the rentals acted penny wise and pound foolish in the matter, and to retrieve the mistake instituted a legal suit for the recovery of the claims.

Lead—The lead mine at Rose Blanche was worked all during the winter. Considerable ore was mined and placed on the surface. Operations there are since the spring opened assuming a much larger scale, and some more men are being taken on. In a few days it is hoped that a cargo of ore will be shipped away.

What is undoubtedly the best lead property in the colony will be reworked again this summer after being closed down for a number of years owing to the difficulty of financing. This property is located at Port-au-Port on the west coast. The ore averages eighty-five per cent. lead, and the quantity is assured. Conditions for shipping are admirable. American capital will finance the working. Already this spring engineers visited the property and reported most favorably after a thorough investigation of the entire area.

Wabana Iron Claims—Quite recently a number of submarine claims which adjoin the holdings of the Dominion Iron and Steel Co. and the Nova Scotia Co. at Wabana were sold for a sum aggregating \$60,000. The claims were sold to private parties who are numbered amongst the shareholders of the companies. In one instance the claims sold numbered nine. Other sales were for claims numbering more or less than these. The claims are said to be very valuable, and contain within their areas ore to the extent and value that will render their acquisition bye and bye, by the companies, a most profitable proposition.

The Copper Smelter—The copper smelter at St. John's which opened about two months ago and did excellent work for about six weeks is now closed down for a short time to be refitted with new linings which burnt out. Mr. W. A. Mackay, who promoted the enterprise, left last week for America, where new and better fittings will be obtained, and as soon as these are refitted work will be recommenced on a good scale, as there are a number of cargoes of ore now waiting to be taken to the smelter.

NOVA SCOTIA

Nova Scotia Mining Society.

The annual meeting of the Nova Scotia Mining Society was held in Sydney on the 5th of May at the rooms of the Society. The meeting was a purely formal one, for the election of officers and the reception of the report of the Council. The following officers were elected for 1916:—President, D. H. McDougall; vice-president, Col. Thos. Cantley; second vice-president, Alfred J. Tonge; secretary-treasurer, E. C. Hanrahan, Sydney; associate secretary-treasurer, E. A. Saunders, Halifax. Members of Council—T. J. Brown, F. W. Gray, J. R. McIsaac, Malcolm Blue, C. M. Odell,

Hon. R. Drummond, Malcolm Beaton, John Johnston, John Casey, Alex. McEachern, R. E. Chambers, Jas. T. Cumming, C. J. Coll, W. H. Graham, F. E. Lucas, Isaac Greenwell. In lieu of the usual expenses attending the annual dinner, which was dispensed with, one hundred dollars was sent to the headquarters of the Nova Scotia Red Cross Society at Halifax.

Dominion Coal Officials.

Several changes are announced in the staff of the Dominion Coal Company, following on the appointment of Mr. D. H. McDougall as general manager of the Dominion Steel Corporation, thereby giving him jurisdiction over the works of the Dominion Iron and Steel Company, in addition to his duties as general manager of the Dominion Coal Company. Mr. Alfred J. Tonge, who has been the mining engineer of the company since 1912, has been appointed general superintendent of mines, in addition to the duties of mining engineer. Mr. J. D. Maxwell has been promoted from the superintendence of No. 2 district to the position of assistant general superintendent of mines. Mr. Alex. S. McNeill, formerly manager of No. 2 Colliery, is appointed superintendent of No. 2 district in place of Mr. Maxwell.

Miners' Wages.

Demands for wage increase have been made at several of the Nova Scotia collieries. The Nova Scotia Steel & Coal Company have given their workmen a substantial increase. The men at the Springhill Mines of the Dominion Coal Company have also been granted an increase, which brings their wages up to about the same level as they were previous to the reduction of ten per cent which was enforced after the United Mine Workers' strike in 1911. The workmen of the Acadia Coal Company have asked for an increase of 25 per cent., and the mines of this company have been idle for about a fortnight. The men have returned to work, and the matter is to be referred to a Conciliation Board.

Mine Supplies.

The price of some mine supplies is becoming a serious matter, particularly the price of explosives. These have increased from three to four cents a pound, while fulminate detonators have doubled in price. Increases in such materials as wire ropes, lumber, all iron and steel supplies, rubber, oils of all kinds, brattice cloth, and many other materials, have also to be faced. When these are added to increased cost of wages, plus most extraordinary transportation rates, it is quite evident that the price of coal must also increase, more particularly so when, owing to the demands of the army, coal outputs are decreased by from 25 to 40 per cent. of the production of the summer of 1915.

Mining Legislation and Politics.

An election is said to be approaching in Nova Scotia, and as is usual at such times the legislators of the Province, on both sides of politics, are occupied in the congenial task of tinkering with mining legislation and baiting the mining companies. For some reason, probably dating back to the breaking of the Duke of York's lease of the minerals of Nova Scotia almost two generations ago, the politicians of the Province have always taken a great interest in the mining laws, and their activity reaches a climax when elections are approaching. This is all very well for the politicians, but it is very bad for the business of legitimate mining companies. An example of this feature of Nova Scotia politics is a bill recently presented to the House

providing that where a lessee holds an idle or abandoned mine, he may be given notice to commence the operation of the mine, failing which the lease can be revoked, and the mine turned over to some one who will undertake to work it. This bill is aimed at one particular property in Inverness County, but the number of idle mines in Nova Scotia is very large, and they are none of them idle except for good and sufficient reasons. A similar attempt has been made to force one of the Pieter companies to operate an idle colliery, notwithstanding that this company has not sufficient men to properly operate the mines it has working. It is becoming more and more evident that coal mining in Nova Scotia is only financially possible by large corporations with adequate financial reserves, and it is one of the features of large coal companies the world over that mines are opened and closed as the market and financial conditions dictate. One of the most striking illustrations of this is the Westphalian Coal Syndicate, a controlling body that succeeded in turning the collieries of Westphalia from profitless ventures to producers of regular dividends, and at the same time rendered it possible to sell coal to customers at a uniform but quite moderate price. Under the rules of this syndicate a colliery that it was inadvisable to operate was closed down. The owners were given a remunerative percentage on the capital invested, and when it became advisable to reopen the colliery, then it was done. Large coal companies in the United States like the Pittsburg Coal Company open and close collieries as they see fit, and it is this very flexibility of operations that makes it possible to prosecute mining operations with profit. But in Nova Scotia, if a colliery is closed, there is an immediate pother. Deputations go to see the political powers that be, and wires are pulled most assiduously. It matters not whether the mine in question be worked out, or flooded, or financially impossible of operation, so long as a political end is served the mine operator has to submit to be made the butt of local politics. The most casual and vicious legislation is drafted to serve an immediate and political end, and it has become necessary for the coal operator of the Province to closely follow every phase of legislation before the Provincial Parliament, unless he wishes to see placed on the statutes some foolish law that will endanger his leases. That there are such things as trust deeds for bond issues subscribed to by persons in the United States, in Great Britain and Europe, seems to trouble these pettifogging legislators very little. It must be confessed that few, if any, of these draft bills become law, as their absurdity is apparent very quickly, but it is the constant threat of ill-considered legislation that is deplorable. A fearful fuss has been made in Halifax because the Port Hood Colliery remains closed. The mine is flooded, and in all probability will remain flooded for ever, but it is thought that another opening could be made on the same lease, and the industry re-started. But the only operating coal company in Inverness is in the hands of a receiver, and that company has not sufficient men to work its mine to full capacity. Just one coal company in the Province is paying a common stock dividend, only one or two can afford a preferred stock dividend, and some cannot even pay bond interest. And then reputedly wise men spend long hours in discussing why mines are closed! Little the shareholders of a coal company living thousands of miles from Nova Scotia care whether a mine is open or closed. They are chiefly interested

in an interest return on the money they have invested in good faith, and politicians may talk until even they are tired, but when all is said it is the possibility of dividends that will decide whether mines shall remain open or closed. If the legislators of the Province think they can compel coal companies to operate collieries under disadvantageous conditions they will speedily find that investors will go to some place where politicians know enough to keep their hands off legitimate enterprise, except, of course, where the need is real, and in that event, no right-minded person will object.

BRITISH COLUMBIA

In connection with the persistent efforts of Robert T. Ward and his associates to oust John Hopp from possession of leases of placer ground at Bullion, Cariboo district, the following press despatch was sent out from Victoria, on May 4: "Because R. T. Ward's counsel agreed weeks ago that he had no more evidence to produce, and because Ward to-day said that any matter he could place before the committee would have no bearing upon the legal points as to whether the special Act of the Cariboo Gold Mining Co. was overridden or not by the General Mining Act the Mining Committee of the Provincial Legislature this morning, by Chairman Hunter's casting vote, refused to reopen the case.

"Two weeks ago the committee deliberated on the evidence and decided to report to the Legislature against taking any action in the case. The committee took the view that the points at issue are purely legal and can only be settled in Court.

"Ward said this morning that he could show there had been a conspiracy to do him out of the placer property involved in the hearing, but the committee members argued that the case had been closed and that it was in any event useless for it to waste further time on a matter which could only be decided by the Courts."

It may be added to the foregoing despatch that the Guggenheim interests, when they sold their "assets" to Ward and his associates for \$20,000, knew full well that their title to the placer ground in dispute had lapsed before this sale, as was shown by their instructing their caretaker to stake the ground in his own name for them and not to discuss the question of title with Ward when he should be given possession of plant, buildings, etc., of which the caretaker had long been in charge. Mr. Hopp and his associates have been for years the largest hydraulic placer-gold mine operators in Cariboo district, so the fact that the continued efforts to dispossess them of ground lawfully acquired by them after the Guggenheim Company had forfeited title to it, have failed, is favorably viewed by many who prefer successful operators to others.

Since the foregoing notes were written, Mr. Parker Williams, an ex-Socialist member of the Legislature, has attempted to induce that body to interfere in the interests of Mr. Ward and his associates, but only the Opposition members in the House supported this further endeavor to do injustice to Mr. Hopp, so now the only recourse Mr. Ward has seems to be to the Courts, one of which, however, early in the dispute, decided that it had no jurisdiction in the matter.

WEST KOOTENAY.

Slocan—Now that the snow is melting and it will soon be practicable to get a pack train up to the property, preparations are being made to undertake the

summer season's work at the **Mountain Con.** This mine is situated at a high altitude. Last year several cars of ore were packed from it down to the railway at Sandon; some of that ore was exceptionally rich, its silver content having been very high.

The report for the month of March of the **Standard Silver-Lead Mining Co.** was issued from the company's office in Spokane, Washington, early in May. The secretary-treasurer stated that the gross income for the month, amounting to \$187,338, was the highest since the company commenced making a considerable output. The net profits were \$136,743, and the company's credit balance at the end of March was \$248,163. Shipments of concentrates and crude lead ore during the month totaled 1,295 tons, and preliminary settlements brought the company \$172,347. On May 10, the company paid its customary monthly dividend of 2½ cents a share; the total of \$50,000 for the month brought the year's profit disbursements up to \$250,000 and the grand total of dividends to \$2,050,000, or \$2.02½ a share paid to shareholders since commencement of dividend-paying in 1912.

Nelson—A news despatch from Spokane, Washington, gives the information that a company has been organized in that city to acquire and develop the Fawn group of mineral claims, situated in Sheep Creek camp, in the southern part of Nelson mining division. This company has been named the Efanjay Gold Mining Co. It is doing development work on a vein of gold ore about 15 inches wide, which is stated to give assay returns from \$21 a ton upward. The 4-stamp mill of the Nugget mine, a neighboring property, has been leased and it is expected that before the end of May there will be available sufficient water to admit of the mill being operated.

The most important mining news received this year from the gold properties in Sheep Creek camp is that of the opening on the 700-ft. level of the **Queen mine** of a shoot of ore which is believed to be the downward extension of the big body of ore that was worked on the 600-ft. level of the mine. The Queen Mines, Inc., is a corporation chiefly of Wisconsin men who for several years have been steadily operating the mine and 20-stamp mill and are understood to have made a considerable profit. The company's manager is Mr. E. V. Buckley, also a Wisconsin man, who has been in charge of the property for several years and has been successful in his efforts to make the mine a profitable producer.

Rossland—The London office of the Le Roi No. 2, Ltd., has published the report of its **Josie mine** for March, received from the company's managers at Rossland, as follows: Shipped 1,512 tons of ore. Receipts from the smeltery were \$15,073, in payment for 1,148 tons of ore; \$113, umpires' award on concentrate; sundries, \$376; total, \$15,562. Estimated working costs for corresponding period were \$5,925 for ore production. There was also expended \$542 on capital account, and \$9,885 on development (including diamond-drilling). Total expenditure on all accounts was \$16,352.

A summary of the Josie mine reports of the Le Roi No. 2 for three months—January, February and March—of 1916, is as follows: Ore shipped to smeltery, 4,043 tons, and concentrate 50 tons. Total receipts for ore and concentrate, \$49,385; sundry receipts, \$1,574; total, \$50,959. Estimated working costs for corresponding period were \$15,445 on ore production, \$400 on milling, \$3,043 on Capital account, and \$29,281 on mine development (including diamond drilling); total, \$48,169. The concentrating mill was operated only for

a part of January. The comparatively large amount spent on mine development indicates that the company is carrying out the policy outlined in its last annual report, in which the following was included in the report of the managers: "We propose to continue during the ensuing year the exploration of the Deep, California, and Josie territory, and to restart work in the No. 1 mine which will lead to our return to exploration on the northern part of our ground."

COAST DISTRICT.

Alice Arm—When on a visit to Trail a few weeks ago, Mr. Wakely A. Williams, superintendent of the Granby Consolidated Co.'s smelteries, who has his headquarters at Anyox, Observatory Inlet, gave the Trail News some information about progress at Alice Arm country, north-east of Anyox, as under:

"The Alice Arm district, situated at the head of an arm of Observatory Inlet, is attracting attention, and there are now about 300 people in there. The most important property, so far as yet disclosed by development, is the **Dolly Varden**, owned by a syndicate composed of stockholders of the Goldfield Consolidated Co. It is a silver-lead property and its orebodies have been extensively prospected by diamond-drilling. The ore contains unusually high values in silver. The mine is to be equipped next summer with machinery for development.

"Another property that is also having attention is the Alice Arm group of copper claims. Like most of the known properties in that region, it lies about fourteen miles back from tidewater, the situation there being much the same as in the case of the town of Stewart in relation to a number of the mines in the Portland Canal division. There occurs on the Alice Arm group a wide vein containing some copper ore of extremely good grade; it is showing up well as the result of the development done on it last winter and of work still in progress.

"The new town at the head of Alice Arm already has a good hotel (which cost \$10,000) and three or four stores. There is likely to be a large incursion of prospectors and working miners into that district in the coming summer."

It may be added that those who have access to the Report of the Minister of Mines for British Columbia for the year 1913 can find, on pp. 79-83, some preliminary information concerning the Kitsaulte copper camp, Alice Arm, together with two sketch maps. While this information is not now up to date, it will serve to give a general idea of the locality and its mineral possibilities. Probably the Annual Report for 1915, now being printed, will give notes of developments in that year.

Progress at Anyox—Mr. Williams also briefly outlined to the Trail News conditions at the **Granby Consolidated Co.'s smeltery** at Anyox. He said:—

"During the last month the smeltery at Anyox has been operating all four furnaces and treating ore at the rate of 80,000 tons monthly, which rate will be maintained from now on. Last winter, which was the most severe experienced for a generation in Northern British Columbia and Alaska, we were badly handicapped by insufficient water power, though we also had in operation a small auxiliary steam plant. This summer we shall install a large auxiliary steam-power plant, so that our operations will not again have to be curtailed for a similar reason to that just mentioned. That is the only important improve-

ment remaining to be provided to make the company's Anyox plant capable of operation at full capacity at all times and seasons. The town of Anyox now has a population of about 1,600. Some 540 men are being employed in connection with the working of the company's Hidden Creek mines, and we have about 400 in and about the smelting works."

MOLYBDENITE MINING IN QUEBEC.

Mr. W. E. Simpson and his associates have formed a company to take over the molybdenite claims at Kawagama, near Amos, in Northern Quebec, and Mr. Simpson is taking in a small plant at once. He has picked up three boilers and mining equipment, and a Huntington mill and he will install a complete oil flotation plant at the first possible moment. Now that transportation is open he will be able to get down the Hurrieanaw River to within a short distance of the claims and the Quebec Government has promised to assist the company in cutting through some low ground over which a portage has now to be made. The orebody is very wide and the syndicate of railway contractors had spent over fifty thousand dollars in sinking some forty or fifty pits on it. Then Mr. Simpson and his associates acquired it from them. There is a ready market for the molybdenum concentrate and utmost haste will be made in getting out the product.

The St. Maurice Mines Co., Ltd., with a capital of \$400,000, has been incorporated under Quebec patent laws to prospect and exploit mines in the Counties of Montcalm, Pontiac, and in the Temiskaming and also in the Abitibi region. The promoters of the company are Messrs. Albert Edward Turner of London, England, dealer; W. E. Simpson of Grantown-on-Spey, Scotland, engineer; Daniel E. Moran, of New York, engineer; A. E. Doucet, C.E., and George Belleau, bank inspector, of Quebec. The head office of the company will be Quebec City.—Northern Miner.

THE HOLLINGER MILL.

Cobalt, May 20.—Now that the Hollinger deal has been formally ratified by the Hollinger shareholders, no time is being lost in knitting the whole system into one compact group.

Work on the mill is being rushed with all the expedition possible. The excavations for the extension of the mill are well in hand. The extension will be under the same roof as the old mill, but there will be a space of 14 feet between them down which a branch of the surface electric tram will run so that all supplies and material can be hauled at a minimum of trouble. The ore from the group of properties will be crushed in the rock house in the leg of the steel head-frame of the central shaft and it will then be transported to a thousand-ton rock bin which will stand approximately where Mr. Globe's house does now. From there it will be taken to the mill up a trestle in inclined skips.

The hundred stamps will be of the Rand type, the first of their kind in the camp. The stems are shorter and there is a greater weight behind each stroke. The orebodies of the Aeme and the Hollinger are in many cases the same. Previously development on both properties has halted at the line, with much duplication of sampling and handling. Now they will be connected without delay and the whole system will become one.—Northern Miner.

PLANT OF CANADIAN MINING AND FINANCE COMPANY.

The administration building is fireproof reinforced concrete construction. It occupies a ground space of 74 feet by 59 feet, with extension 24 feet by 16 feet. There are a basement and three storeys. The first floor is devoted to management and accounting; the second floor is devoted to the technical staff and draughting rooms; the third floor provides living accommodations for a number of the staff. The building is located upon the property of Aeme Gold Mines, Ltd., and will cost when completed approximately \$38,000.

The air compressing plant is located upon the property of Hollinger Gold Mines, Ltd., being situated at the edge of Gillies Lake, and occupies a ground space of 157 feet by 54 feet. The entire building is constructed of steel and reinforced concrete and is fireproof throughout. The installation consists of three compound air compressors, having a capacity of 4,500 cubic feet of free air per minute each, with space left for the installation of a fourth unit. The compressors are electrically driven and the entire electrical and mechanical equipments are the best obtainable. An emergency boiler plant of 1,800 horsepower capacity has been provided for generating power in case of failure in the hydro-electric supply. An equipment of pumps for supplying water to the mill of Hollinger Gold Mines, Ltd., and an emergency fire pump are also installed. The entire plant has been designed and constructed for permanent work and has cost, including distributing pipe lines, \$244,273.

In order to keep pace with the demand for increased tonnage, Canadian Mining and Finance Co., Ltd., has under construction a Central Hoisting Plant and Shaft. The shaft is six compartment and is concrete lined, all six compartments have been sunk to a depth of 500 feet with a station established at the 425-foot level. Two compartments have already been carried down to a depth of 800 feet, where a second station has been established, and the remaining four compartments will be stoped out during the present year. Surmounting the shaft is a steel head frame. This frame is 120 feet in height. There is being installed a crusher station, having a capacity of 5,000 tons per twenty-four hours. The electrically driven hoists and other electrical apparatus will be housed in a concrete building. Up to January 1st, 1916, the expenditure upon this shaft and plant had amounted to \$65,454, and it is estimated that a further expenditure of approximately \$200,000 will be necessary to complete the plant and provide means of transporting the crushed ore to the mill.

Altogether, up to January 1st, 1916, Canadian Mining and Finance Co., Ltd., had invested in plant and equipment \$483,695.97.

MANGANESE CHAINS.

The Jeffrey Manufacturing Co. has ready for distribution a bulletin on manganese chains. They say: "This bulletin contains full details and prices of our Detachable, Peerless and Hercules type of Manganese Chains, Sprockets and Attachments, which insure a maximum of elevator and conveyer service in aggravating cases of wear, where the conditions require that the chains and sprockets not only handle gritty and abrasive materials, but come in actual contact with them."

COLUMBUS.

The Columbus Cobalt property in south Coleman is to be developed this year. The Columbus adjoins the Adanac.

MARKETS

NEW YORK MARKETS.

May 19, 1916—Connellsville Coke—

Furnace, spot, \$2.25 to \$2.40.

Contract (nominal), \$2.50 to \$3.00.

Foundry, prompt, \$3.50 to \$3.75.

Contract, \$3.50 to \$3.75.

May 22, 1916—Straits, Tin, nominal, 48.75 cents.

Copper—

Prime Lake, nominal, 28.50 to 29.00 cents.

Electrolytic, nominal, 29.00 to 29.50 cents.

Casting, nominal, 26.75 to 27.25 cents.

Lead, Trust price, 7.50 cents.

Lead, outside, 7.25 to 7.35 cents.

Spelter, prompt western shipment, 15.05 to 15.30 cents.

Antimony—

English brands, nominal, Chinese and Japanese, 29.00 to 30.00 cents.

American, 29.00 to 30.00 cents.

Aluminum—nominal.

No. 1 Virgin, 98-99 per cent., 59.00 to 61.00 cents.

Pure, 98-99 per cent., remelt, 57.00 to 59.00 cents.

No. 12 alloy, remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$86.00.

Platinum, nominal, \$80.00.

Cobalt (metallic), \$1.25.

Silver (official), 71.25 cents.

Metal Produce—All prices are nominal as follows:

Sheet copper, base, 37.50 cents.

Copper wire, base, 32.50 to 33.50 cents.

High sheet brass, base, 38.00 cents.

Seamless brass tubing, 43.50 to 44.50 cents.

Seamless copper tubing, 43.50 cents.

Brazen brass tubing, 43.50 to 44.50 cents.

Brass wire, 38.00 cents.

Brass rods, 38.00 cents.

Sheet zinc, f.o.b. smelter, 24.50 cents.

TORONTO MARKETS.

May 25—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.

Lead, 9 cents per lb.

Tin, 54 cents per lb.

Antimony, 35 cents per lb.

Copper, casting, 31 cents per lb.

Electrolytic, 31½ cents per lb.

Ingot brass, yellow, 16 cents; red, 21 cents per lb.

May 25—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto, Ont.)

May 23, 1916.

New York Curb.

	Bid.	Ask.
Atlantic Steel	60.00	62.00
Alta. Cons.	52.00	55.00
Butte.	7.00	7.25
Can. Car	68.00	71.00
Curtiss Aeroplane	48.00	53.00
Chevrolet.	234.00	235.00
Can. Copper	2.32	2.35
Chandler Motors	103.50	104.00
Chalmers	145.00	175.00
Cambric Steel	81.00	81.50
Con. Ariz.	1.58	1.62
Emma Copper	67.00	69.50

Howe Sound	5.75	6.00
Inter. Nickel (New)	45.87	46.00
Kennecott Copper	55.50	56.00
Maxim Munitions	7.00	7.25
Midvale Steel	61.25	61.50
Marconi.	3.12	3.25
Magna.	16.50	17.00
Mother Lode	32.50	33.50
Steel of Canada	61.00	53.50
Submarine Boat	38.00	38.50
Tonopah Extension	6.75	6.87

Porcupine Stocks.

	Bid.	Ask.
Apex.	.08	.08½
Dome Extension	.35½	.35¾
Dome Lake	.28½	.29
Dome Mines	.26	.27
Foley O'Brien	.40	.51
Hollinger	29.75	30.10
Jupiter.	.36	.36½
McIntyre.	1.96	1.98
McIntyre Extension	.37	....
Porcupine Crown	.77	.79
Porcupine Imperial	.04	.04½
Porcupine Vipond	.61	.62
Preston East Dome	.05¾	.06
West Dome Con.	.35¼	.35½

Cobalt Stocks.

	Bid.	Ask.
Adanac.	.63	.65
Bailey.	.09½	.09¾
Beaver	.41	.42
Buffalo	1.00	1.50
Chambers Ferland	.27	.27½
Coniagas.	5.00	5.40
Crown Reserve	.48	.54
Foster	.09	.10
Gifford	.07	.08
Gould .....	....	.00¾
Great Northern	.05	.06
Hargraves	.04½	....
Hudson Bay	.40	.45
Kerr Lake	5.00	5.14
La Rose	.65	.75
McKinley	.59	.62½
Nipissing .....	....	.08
Peterson Lake	.28	.28½
Right of Way .....	....	.06
Rochester .....	....	.05
Seneca Superior	.52	.54
Temiskaming	.68	.68½
Trethewey	.25	.28½
Wetlaufer	.07	.09

SILVER PRICES.

	New York.	London.
May—	Cents.	Pence.
9.	73¼	35 1/16
10.	76¼	36½
11.	76½	36¾
12.	77¼	37
13.	77½	36 1/16
15.	75½	36¼
16.	75¾	36¼
17.	75¾	36¼
18.	75¾	36¼
19.	75½	36¼
20.	75¼	36
22.	71¼	34

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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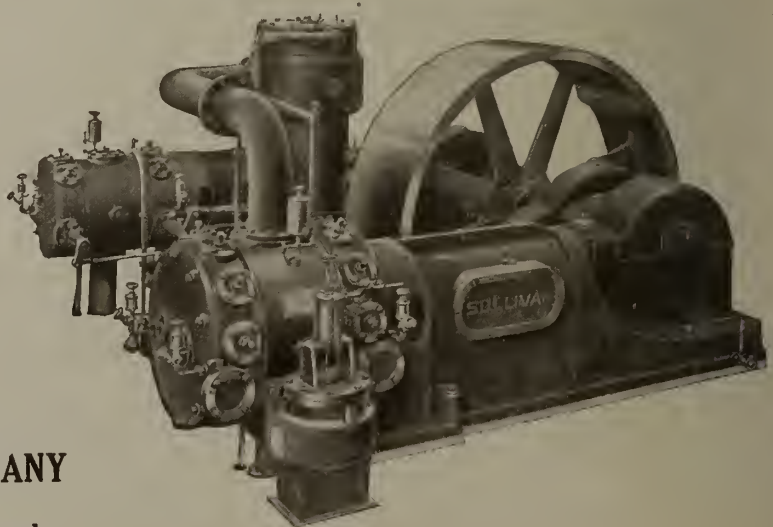
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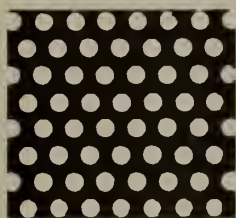
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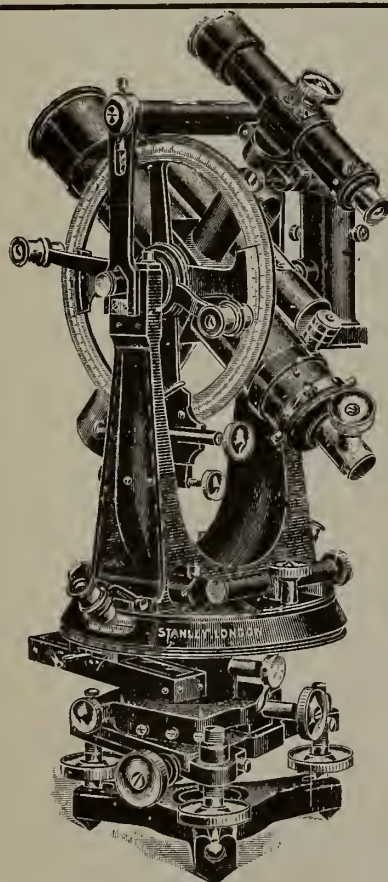


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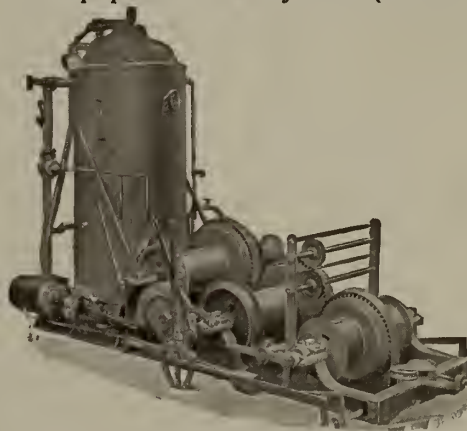
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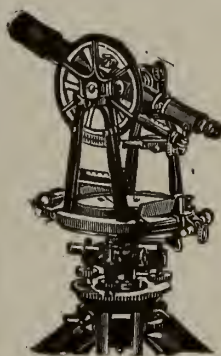
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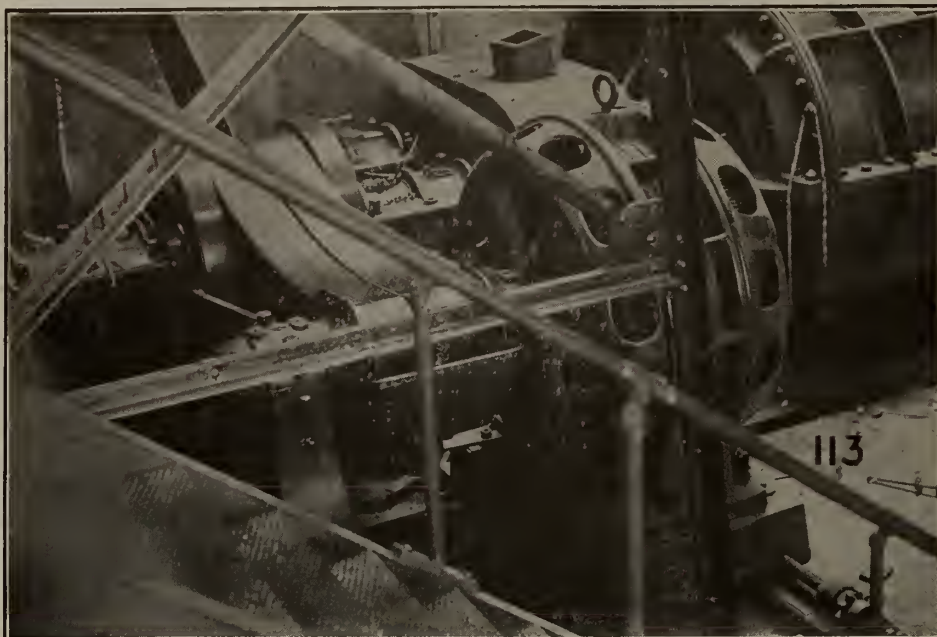
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THE CANADIAN MINING JOURNAL

VOL. XXXVII.

TORONTO, June 15, 1916.

No. 12

The Canadian Mining Journal

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"CANADIAN MINING REVIEW"

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Published fortnightly by the

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Head Office 263-5 Adelaide Street, West, Toronto
Branch Office 600 Read Bldg., Montreal

Editor

REGINALD E. HORE

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CIRCULATION

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THE COBALT SILVER AREA

During the past few years the Cobalt district has been producing large quantities of silver, but exploration has not been carried on as vigorously as it might have been. During the past few months, however, there has been a revival of activity and it is not unlikely that discoveries of considerable importance will be made this year. The price of silver, while falling off considerably during the past few days is much higher than at any time for years and it is likely to remain so. This means greater profits from operations and has given new life to the district, bringing larger returns to shareholders of silver mining companies and permitting increase in wages.

It is now nearly thirteen years since the men working on the railway built to tap the great clay belt of Northern Ontario first paid serious attention to the mineral deposits in the vicinity of Long lake, now Cobalt lake. Since then there has been produced about one-quarter billion ounces of silver worth about \$130,000,000. It is generally believed that the zenith of production has been passed and that most of the veins have been discovered. It is folly to conclude, however, that exploration has been so thorough as to preclude the possibility of very considerable bodies of rich ore being still unfound. In fact it is very probable that exploration will prove the existence in the heart of the Cobalt area of many deposits that have yet escaped discovery. Structural conditions indicate that there may be at Cobalt many undiscovered deposits which do not outcrop, which the surface prospector has no chance of finding.

It is true, as might be expected, that the companies operating at Cobalt have done much underground prospecting. The development and prospecting work at the mines has resulted in the discovery of very many veins which do not outcrop. It has proven also that the vertical extent of most of the deposits is very small and that most of the ore is enclosed in the lower part of sedimentary rocks of the Cobalt series close to the underlying Keewatin rocks.

Much of the underground prospecting has been disappointing. It has, however, afforded information regarding the structural features of the deposits and is therefore not without value. It is to be hoped that the information gained will be recorded in such a way that it may prove useful to operators exploring neighboring properties.

Some of the companies operating in one section of the Cobalt area have made arrangements for careful study of structural conditions and for their accurate recording with a view to more intelligently directing

prospecting work on these properties. This is a step in the right direction and it is to be hoped that other companies will undertake such work and that all will give freely such information as is likely to be of assistance to the others.

If the information which the underground workings at Cobalt have disclosed is carefully collected and studied it is not unlikely that the existence of undiscovered ore will be indicated. Enough is known already to give courage to those who are undertaking exploration.

Until much more prospecting has been done at Cobalt we will be unwilling to admit that the possibilities of the area have received the attention they merit. It has been too readily assumed that all the ore is near the surface.

ONTARIO'S NICKEL-COPPER PRODUCTION

Ontario's production of nickel, in the form of matte, in 1915 was 34,039 tons, valued at \$17,019,500. The present rate of production indicates a production of 40,000 tons in 1916. The value of this nickel as it leaves the smelter at Copper Cliff is estimated at \$20,000,000. Its value when refined should be about \$30,000,000.

During 1916 the nickel mines at Sudbury will also produce 22,000 tons copper. The value of this copper as it leaves the Copper Cliff smelter is estimated at \$8,000,000. Its value when refined should be about \$12,000,000.

The total value of the nickel-copper matte shipped from the Sudbury district during 1916 will be, at present production and prices, about \$28,000,000. The value of the refined product will be about \$42,000,000. Against the cost of refining and selling the producers will therefore have an item of \$14,000,000.

Over two-thirds of the nickel and copper produced from Ontario ores is mined and smelted in Ontario by the Canadian Copper Co. and then shipped to New Jersey for refining. The present profits of the International Nickel Company are so large that the delay in the establishment of that refinery in Canada can scarcely be attributed to lack of funds.

It is the announced intention of the International Nickel Company to establish in Canada a refinery of sufficient capacity to supply the needs of the Empire. It is to be hoped that the delay means that investigation has proven the desirability of refining all the matte in Canada.

Good results are being obtained in development work north of The Pas. The Canadian Government Railway now under construction in Northern Manitoba, seems destined to play an important part in the development of Canada's mineral resources.

PRE-CAMBRIAN ORE DEPOSITS

The important discoveries north of The Pas should result in directing much attention to the Pre-Cambrian rocks in Northwestern Canada.

Ontario's chief metalliferous deposits are in Pre-Cambrian rocks,—Cobalt silver, Porcupine gold and Sudbury nickel-copper ores occurring in these old formations. The Michigan copper deposits and the great iron deposits of the Lake Superior states occur in the Pre-Cambrian. It has been confidently expected therefore that the unexplored broad expanse of Pre-Cambrian in Canada would prove to be the source of great wealth. The discovery of great deposits of sulphide ore on the Manitoba-Saskatchewan boundary strengthens that opinion and indicates that exploration of the hinterland will continue to result in the discovery of ores, the extension of the mining industry and the development and settlement of parts of the Dominion now uninhabited.

In Ontario, prospecting is resulting in many promising discoveries being made. The area proven to contain gold in considerable quantity has been greatly widened during the past year. The wonderful ore developed at the Croesus mine in Munro township would cause a great sensation, but for the splendid developments at Porcupine mines. The enormous orebodies developed at the Hollinger and Dome and the more recent discoveries at the McIntyre have placed Porcupine far in the lead among Canada's gold camps. While overshadowed by Porcupine, Kirkland Lake, Munro and Boston Creek areas are proving up well, and prospectors are reporting many discoveries in various parts of what is proving to be a very large gold bearing district.

At Flinflon lake, on the Manitoba-Saskatchewan boundary, in an area of Pre-Cambrian rocks, there is being explored by diamond drilling an enormous deposit of sulphide ore. The size and content of this mass has still to be determined; but enough has been learned to make the owners satisfied that they have a very valuable deposit. The Pre-Cambrian areas in the vicinity are naturally receiving close scrutiny. They warrant attention.

A map of the Boston Creek gold area, prepared by Mr. A. G. Burrows, of the geological staff of the Ontario Bureau of Mines, is nearly ready for distribution. The Bureau is to be congratulated on its success in meeting the needs of prospectors. The Deputy Minister of Mines and the Provincial Geologist lost no time in investigating the first discoveries at Cobalt and, in keeping with the reputation then gained, their Department has greatly assisted in the opening up of new districts ever since.

PUBLIC PRINTING

In the third report of the Committee on Parliamentary Printing, Mr. Currie says: "During the past two or three years changes have been made in the typographical arrangements of several blue books, whereby considerable economy has been effected. On these books an annual saving of \$15,000 has been made."

From such a statement one may gather some idea of the waste that characterizes many Government reports. It indicates that the saving which might be made is a very considerable one, and worthy of the attention of those responsible for such reports.

Government reports are necessary and many of them are of great value. Among the most useful are those published by the Geological Survey and the Mines Branch. They record the work of many careful investigators and assist greatly in the development and utilization of our mineral resources. Many of the publications, however, in common with reports of other Departments, would be more useful and would have cost less if more attention had been given to the editing and printing. The saving that might be effected by changing the typographical arrangement is a large item. A further large sum might be saved by limiting distribution to those who make use of the reports.

Perhaps the most important saving could be effected by impressing the authors with the fact that the verbose reports are very likely to be shelved or thrown away. As one correspondent says of the publications of several Departments: "These reports would be read if they were concise." Valuable information, collected by great expenditure of labor and money, becomes lost in the mass of words.

CORRESPONDENCE

A MISLEADING ESTIMATE.

The Editor of The Canadian Mining Journal:

Sir,—Information has reached me that a letter from a member of the Canadian Mining Institute, making certain allegations against myself, is to be published in the June number of the Monthly Bulletin of that institution. If the secretary of the Institute had given me opportunity to correct in the same issue whatever mis-statements there are in that letter, I should not now ask you to permit me to address members of the Institute through the columns of your Journal. I think it well, though, rather than wait until a month shall have elapsed ere I can do so through the Monthly Bulletin, to make it clear that while I am not at all concerned about the opinions of myself held by certain self-important persons, I hold very strong views on the subject of publishing misleading information in the official publication of the Institute.

The following self-explanatory letter was sent by me to the editor of the C. M. I. Monthly Bulletin, but, so far as I have seen, was not printed in that publication:

"Victoria, B.C., January 10th, 1916.

"The Editor, Monthly Bulletin of C.M.I.:

"Sir,—With much regret I to-day find that the Bulletin has been permitted to become a medium of publicity for what I believe to be an inflated estimate of the

mineral production of British Columbia for 1915. So far as I am able to judge, not only is there little probability of a total equal to that of 1913 (\$32,440,800), being reached, but returns received this month make it appear that even my own estimate of \$30,375,000 made last month for the 'Annual Financial Survey' of the Toronto Globe is too high. May I ask you to publish this intimation from me—that if the Bulletin is to be made, even occasionally, a channel for the dissemination of 'hot air' from Vancouver or anywhere else in British Columbia, my name must be removed from its list of regular correspondents. Had I known in time that you would accept so inflated an estimate, I certainly would not have taken the trouble to prepare for you the summary review for 1915 that I have done.

"E. Jacobs."

I inadvertently omitted inverted commas when quoting from the Bulletin for January the misinformation that the value of the 1913 production was \$32,440,800; that was the total for 1912, which was the year of highest record.

The position as to the estimate of the value of last year's production is as follows: In December I made an estimate of a total of \$30,375,000. Too late to have correction made I was informed that the official who supplied the figures for one important colliery had made a mistake of 100,000 tons of coal, equivalent to \$350,000. Then, I guessed the miscellaneous production — chiefly building materials, etc. — at \$2,000,000, which was nearly \$853,000 less than the corresponding total for 1914. A month later, the Provincial Mineralogist decided on an estimate of \$1,500,000. If the difference of \$850,000 thus accounted for be deducted from my December estimate of \$30,375,000, there will be left a sum of \$29,525,000, or approximately \$225,000 more than the preliminary estimate of the Provincial Mineralogist, and only \$75,000 more than the revised total of \$29,447,508 now on official record. The wild guess of the Vancouver 'hot air' man was \$3,141,000 in excess of the official preliminary estimate and \$2,993,000 more than the figures of the final total. I hope members of the Institute will feel appropriately grateful for having been supplied in the Monthly Bulletin with the conclusions of an authority possessing such manifest qualifications as those of the Vancouver correspondent of the Bulletin.

E. JACOBS.

Victoria, B.C., June 1st, 1916.

With mining activity on its western boundary and at Rice Lake, Manitoba is attracting attention these days. The Flinflon district will be visited by many mining men this summer.

The province, unfortunately, does not control its mineral resources and little assistance in development is to be expected unless the Federal Government recognizes the advantages to be gained.

ROCHESTER.

The Trethewey Mining Co. is exploring the Rochester property by a crosscut from a shaft on the Lumsden. The crosscut is being driven near the contact between the diabase sill and the Keewatin rocks, on the supposition that that horizon is the most promising. Results so far are encouraging, some small bodies of ore having been encountered.

ONTARIO'S METAL PRODUCTION

Returns made to the Bureau of Mines by the metal-liferous mines and works of the Province of Ontario for the first three months of 1916, show increases in all products except iron ore. Following are the figures, those for the corresponding period of 1915 being added for comparison:

	Jan.-Mch., 1915.	Jan.-Mch., 1916.	Inc. or Dec.
Gold, oz.	76,307	107,818	*31,511
Silver, oz.	5,230,167	5,297,831	*67,664
Copper, tons	3,644	5,491	*1,847
Nickel, tons	6,680	10,032	*3,352
Iron ore, tons	28,332	6,573	†21,759
Pig iron, tons	94,678	160,749	*66,071
Cobalt, metallic, lb.	450	36,460	*36,010
Nickel, metallic, lb.		11,976	*11,976
Cobalt and nickel oxides, lb.	16,324	143,212	*126,888

*Increase. †Decrease.

The value of the production for the first three months of 1916 was \$14,276,382, as compared with \$9,358,210 for the corresponding period of last year. This large increase was due not only to the greater output but to the higher prices now prevailing for most of the metals.

Gold.—The increase in the yield of gold was 31,511 ounces, worth \$656,872. Compared with the rate of production for the whole of last year the advance was less marked, but developments now under way are likely to lead to a substantial increase. Poreupine provided the bulk of production, namely 99,282 ounces. Hollinger led in output, followed by Dome, Acme, McIntyre-Poreupine, Poreupine Crown, Vipond, Schumacher and Dome Lake in descending order. The mines situate elsewhere making up the remainder of the yield are Tough-Oakes and Croesus. Consolidation of the Hollinger, Acme and Millerton interests will no doubt lead to a more extensive development and a greater output from these properties.

Silver.—A feature of the quarter was an actual increase in the yield of silver as compared with the first three months of 1915, amounting to 67,664 ounces. In value the increase was proportionately greater, namely, \$462,673. This was due to the remarkable rise in the price of silver, amounting to about 50 per cent. over the average figure for 1915. A large part of this increase took place in the latter part of the quarter and afterwards, consequently the benefit of the higher prices was only partially realized during the three months. The natural effect of the advance has been to stimulate both mining and prospecting in Cobalt and to enable low grade ores in the mines or on the dumps to be worked, which at the former low prices of silver were without value. Nipissing continues to lead in quantity of output; Townsite City, Seneca Superior, Kerr Lake, LaRose, Coniagas, Cobalt Lake, McKinley-Darragh-Savage, Beaver, etc., follow in the order named.

Nickel and Copper.—The demand for nickel and copper, due to the war, has been insatiable, and the Sudbury mines have shown a capacity for meeting the requirements which could scarcely have been anticipated. The output of nickel and copper in the matte was each 50 per cent. greater than in the first three months of 1915. If the present rate of production is maintained throughout the year, 1916 will see about 40,000 tons of nickel and 22,000 tons of copper turned out by the

smelters in the Sudbury district, as against 34,000 tons of nickel and 19,600 tons of copper in 1915. The Canadian Copper Company and the Mond Nickel Company are the producers; the Alexo mine turning out a small quantity of ore which is sold to the Mond company.

Iron.—The blast furnaces of the Province produced about 70 per cent. more pig iron than they did in the first quarter of 1915, and the product was worth almost 100 per cent. more. About 15 per cent. of the iron ore charged into the furnaces was taken from deposits in Ontario, the remainder coming from the United States.

By-products of Silver.—Cobalt oxide and nickel oxide met with a rather better demand, though the quantities exported are still below those of normal times. Metallic cobalt is coming into use, principally in steel alloys, and there is now a small quantity of nickel refined in Ontario from the silver-cobalt ores of the Cobalt camp.

COBALT AND THE GOVERNMENT RAILWAY.

Cobalt has not only paid for the T. & N. O. Railway twice over, but the people have in the railway, now that it is connected with the National Transcontinental, a valuable property which enhances the value of the agricultural lands and timber limits tributary to it, and offers an incentive to the opening of mineral areas such as Poreupine.

Cobalt has not only brought great profit to the Province of Ontario, but it has established faith in the mineral resources of the great pre-Cambrian regions, which occupy fully one-half of the surface of Canada. Lying on the southern point of these regions, it offers encouragement to the prospecting of the vast, and little known, territories of the hinterland.



DR. W. G. MILLER
Provincial Geologist, Ontario.

SILVER DEPOSITS OF THE COBALT DISTRICT

Silver was first found at Cobalt in 1903, during the construction of the Ontario Government Railway. During the summer many of the workers had noticed pecu-

that time attracted little or no attention, although it occurred in profusion in two or three of the weathered outcrops."



COBALT STATION, JUNE, 1905



PROSPECTORS AT COBALT IN 1904.

From left to right—

STANLEY GRAHAM,
 PROF. S. F. KIRKPATRICK,
 Queen's University, Kingston.
 ANSON CARTWRIGHT,
 PROF. WILGAR,
 C. ROSS,
 ALEX. LONGWELL,
 Vice-President Coniagas Mines
 T. F. SUTHERLAND,
 Chief Inspector of Mines of Ontario.
 FRASER REED,
 Superintendent Coniagas Mine.
 VINCENT GLEASON,
 CYRIL W. KNIGHT,
 Assistant Provincial Geologist.

liar minerals in the rocks, and a few of them did some prospecting. Fred La Rose, blacksmith, spent some of his spare time in examining outcrops in the vicinity of his smithy, north of Cobalt lake, and located the claim which became known as the La Rose. At the south end of the lake two contractors, engaged in getting out ties for the railroad, found silver ore and located the McKinley-Darragh claims.

In October, 1903, Mr. Arthur Ferland, who located several claims at Cobalt, including the property which was taken over by the Nipissing Mining Co., showed samples of niccolite to Mr. Thomas Gibson, Deputy Minister of Mines of Ontario. Mr. Gibson sent a sample to Dr. W. G. Miller, Provincial Geologist, and asked him to examine the deposits. Dr. Miller, in his report, says of his first visit:

"At the time of my arrival in the district, in November, 1903, four veins, all of which were very rich, had been found. Three of these were within sight of the railway, and the fourth was a short distance to the southeast. The blackened, tarnished silver had up to



Canadian Bank of Commerce, Cobalt, 1905.

The Ontario Bureau of Mines, and particularly Dr. Miller, thus came into close touch with developments at Cobalt at a very early stage in its career and has played a very large part in its development. During the winter of 1903-04 publicity was given to the discoveries, and in the spring the preparation of a geological map of the area was begun by Dr. Miller and Mr. Cyril Knight. Their map was of great service to the pros-

morphosed rocks which they designated as Keewatin. On these lies a series of sedimentary rocks: conglomerate, greywacke, etc., which they call the Cobalt series. The Keewatin and Cobalt series are intruded by sills of diabase which Miller and Knight call the Nipissing diabase.

Most of the silver deposits occur in the sedimentary Cobalt series, some in the Nipissing diabase and some



Cobalt in November, 1905



Lang Street, Cobalt, September, 1911

pectors and served as a key to the geology of a large area of Pre-Cambrian rocks.

It was soon found by Miller and Knight that the rocks at Cobalt of economic importance were of three ages. There is an old complex series of much meta-

in the Keewatin rocks. Most of the ore occurs in rocks which were probably at one time covered by diabase. Some occurs in rocks above the sill. The supposed structure is indicated in the accompanying diagrams taken from Dr. Miller's report.

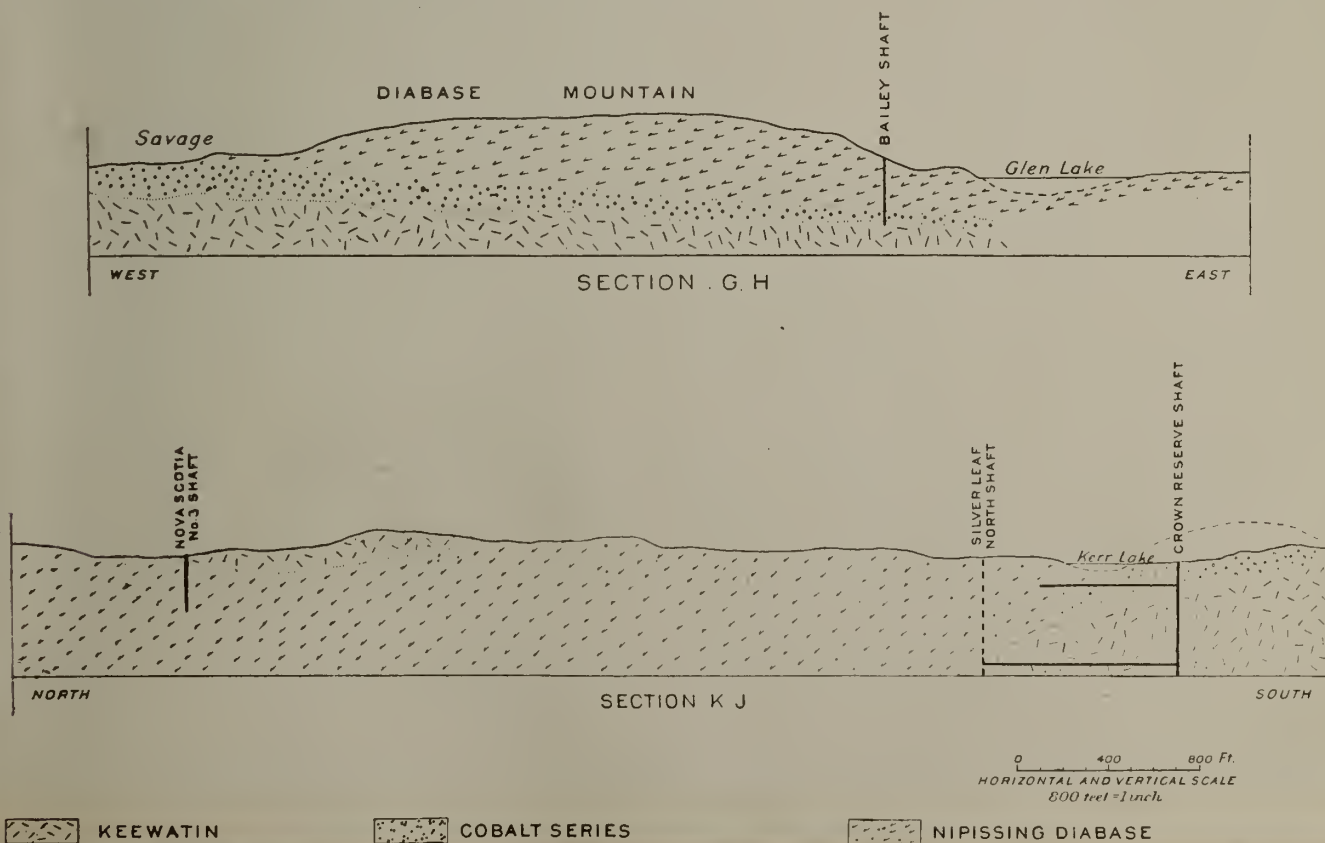


VIEW SHOWING THE RELATION OF ROCKS OF COBALT AREA
 Keewatin complex is overlain by Cobalt series sediments. The diabase is in form of a sill.

SECOND EDITION, APRIL 1913.

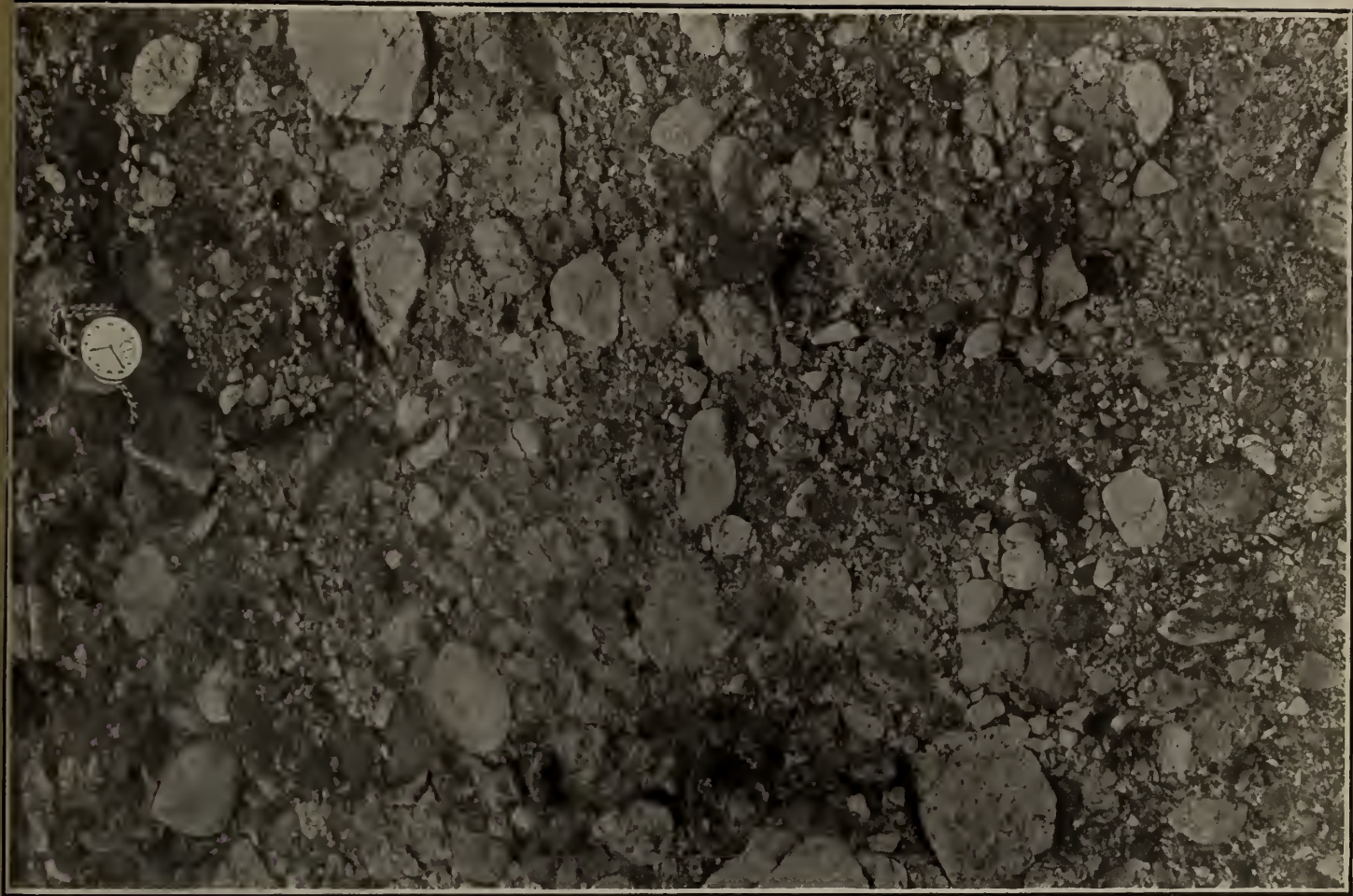
PLATE II

The position of Sections is shown on the map of COBALT, scale 800 feet to an inch.





Nipissing diabase, Cobalt.



Conglomerate of Cobalt series, Cobalt.



Coarse boulder conglomerate of the Cobalt series, Cobalt.





Characteristic weathered surface of fine-grained Keewatin greenstone, Cobalt.



Ellipsoidal basalt, of Keewatin series, Cobalt.

SILVER PRICES IN NEW YORK.

Average monthly prices of silver in New York, per fine ounce, as published by "The American Metal Market":—

	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.
January	47.57	57.05	60.69	65.29	68.67	55.67	51.75	52.37	53.79	56.22	62.93	57.56	48.89½	56.77
February	47.89	57.59	61.02	66.11	68.83	56.01	51.47	51.53	52.22	59.04	61.64	57.50½	48.48	56.75
March	48.72	56.74	58.05	64.60	67.52	55.36	50.47	51.45	52.74	58.37	57.87	58.07	50.24	57.93
April	50.56	54.20	56.60	64.76	65.46	54.50	51.43	53.22	53.33	59.23	59.49	58.52	50.25	64.41
May	54.11	55.43	57.83	66.98	65.98	52.79	52.90	53.87	53.31	60.88	60.36	58.18	49.91½	74.27
June	52.86	55.67	58.43	65.39	67.09	53.66	52.54	53.46	53.04	61.29	58.99	56.47	49.03	....
July	53.92	58.10	58.92	65.10	68.14	53.11	51.04	54.15	52.63	60.66	58.72	54.68	47.52	....
August	55.36	57.81	60.26	65.95	68.74	51.63	51.12	52.91	52.17	61.61	59.29	*54.34	47.18	....
September	58.00	57.12	61.69	67.93	67.92	51.72	51.45	53.30	52.43	63.08	60.64	53.29	48.68	....
October	60.36	57.92	62.03	69.52	62.43	51.43	50.92	55.49	53.34	63.47	60.79	50.65	49.38½	....
November	58.11	58.45	63.85	70.81	58.67	49.65	50.70	55.64	55.72	62.79	58.99	49.10	51.71	....
December	55.37	60.56	64.85	69.05	54.56	48.77	52.23	54.43	54.90	63.37	57.76	49.38	54.97	....
Average.....	53.57	57.22	60.35	66.79	65.32	52.86	51.50	53.49	53.30	60.83	59.79½	54.81	49.69	....

*Quotations suspended August 1st to 21st.

WORLD'S PRODUCTION OF SILVER.

According to figures issued by the Director of the United States Mint. (Fine ounces.)

	Quantity.	Value.
1882	86,472,091	\$98,232,300
1883	89,175,023	98,984,300
1884	81,567,801	90,785,000
1885	91,609,959	97,518,800
1886	93,297,290	92,793,500
1887	96,123,586	94,031,000
1888	108,827,606	102,185,900
1889	120,213,611	112,414,100
1890	126,095,062	131,937,000
1891	137,170,000	135,500,200
1892	153,151,762	133,404,400
1893	165,472,621	129,119,900
1894	164,610,394	104,493,000
1895	167,500,960	109,545,600
1896	157,061,370	105,859,300
1897	160,421,082	96,252,700
1898	169,055,253	99,742,600
1899	168,337,452	101,002,600
1900	173,591,364	107,626,400
1901	173,011,283	103,806,700
1902	162,763,483	86,264,700
1903	167,689,322	90,552,200
1904	164,195,266	95,233,300
1905	172,317,688	105,113,700
1906	165,054,497	111,721,100
1907	184,206,984	121,577,100
1908	203,131,404	108,655,100
1909	212,149,023	110,364,400
1910	221,715,763	119,727,000
1911	226,192,923	122,143,800
1912	224,310,654	137,883,800
1913	223,907,845	135,246,400
1914	211,339,749	116,849,900
1915 . . . . .	.....	.....

The gross freight revenue of the Temiskaming and Northern Ontario Railway in 1915 was \$997,342. Of this \$445,843, or 46 per cent. is attributed to the mining industry.

THE PRICE OF SILVER

A distinctly interesting article bearing on the price of silver appears in the Financial News of London, England, from which we quote the following:

Messrs. Samuel Montagu & Co., in their bullion circular, give the principal explanation of the rise. We can hardly do better than quote one passage: "Not only the position of the market at present, considered as a whole, but also its strength, is unique. The quotation fell quite as heavily when silver was demonetized upon a large scale; but no advance in the price has ever been so sustained. Now an exactly reverse operation is taking place. Silver is being monetized upon a large scale." Here we have the position in a nutshell. The persistent and sustained advance cannot be attributed to speculation, though in every prolonged movement like that now being witnessed the speculative fraternity is fairly certain to fasten on the hem of the investment garment. Speculation now exercises virtually no influence upon the fluctuations in the metal. The buying is not confined to one Government alone; hence the strength of the market.

For half a century the price of bar silver has continued on the down grade until last year it reached what may be regarded as its nadir, of 23½d per ounce. To what heights it will soar remains to be seen. The chances are in favor of a further recovery towards the old level of 60d; when the movement will be stayed depends upon various factors. According to some views there is a "national limit" to the rise, the limit being reached when it would be profitable to send rupees back from India to be melted. Before such a stage is reached a further 8d or so per ounce must be added to the existing price, while at 46d Messrs. Samuel Montagu and Co. are of opinion that it would begin to be worth while to ship the Straits dollar to Europe for refinement. Such an authoritative statement is worthy of consideration. But the point that does not seem quite lucid is whether sufficient rupees and Straits dollars could be collected for shipment here to satisfy all demands. As already mentioned, the claims on the silver production of the world are not confined to this country or to India; the requirements are general. Supposing hoards of Eastern silver could be secured

for Europe, would the character of the natives change, or would there be a desire to replenish?

Messrs. Samuel Montagu and Co. recognize difficulties; for they say: "An advance in the price of silver to 45d would create a serious problem for the Imperial authorities. Considering the size of the stock of rupees, it would be impossible to recall and remint the metal quickly into a coin with less silver content." India is a large user of silver, and, as the stock of rupees seems to be diminishing, it would be interesting to learn whether she is coming forward again as a purchaser. In some quarters the view is held that, with gold vanishing and with paper currencies expanding in various countries, some scheme will be attempted—not necessarily in this country—to establish a silver backing to the notes. Who shall say that impoverished Germany may not have to revert to silver, or take steps in this direction, to give some value to the mass of worthless paper which she has printed during the war? China is not a negligible quantity where silver is concerned. There is a movement in that country for a standardization of coinage. Should this proposal eventuate the influence upon the price of silver would be pronounced.

THE PLACE AND USES OF SILVER

By Thomas W. Gibson, Deputy Minister of Mines,
Ontario.

In common speech, silver is linked with gold as one of the "precious metals," but this should not be permitted to obscure the fact that, unlike gold, silver is a commodity pure and simple, whose price depends upon supply and demand. The general abandonment of silver as a basis for currency has deprived it of any claim to fixity of value in relation to gold.

Nevertheless, the production of silver has for many years gone on at an increasing rate. This has been due in large part to the fact that the most important sources of silver are not primarily ores of that metal, but ores of gold, copper and lead which carry a sufficient proportion of silver to warrant its recovery as a by-product. Cobalt is one of the few camps where silver is worked for itself, and so far the richness of its ores has enabled the mines to produce freely, notwithstanding the low prices which in the main have prevailed since they were opened.

For coinage purposes silver disputes, or rather divides, the field with gold, copper and nickel. In all countries gold is used for coins of the largest value, silver for those of medium, and copper or nickel for those of smaller computation. The fact that the present intrinsic value of silver coins is much less than their face or denomination value does not appear to detract from their usefulness, which primarily depends upon their ability to pass from one person to another without demur. That a 50-cent Canadian coin, the silver in which is worth 75 cents per ounce only, say, 26 cents, or a 25-cent piece worth only 13 cents, circulates freely at face value is due not only to the coins being legal tender, but also to the circumstance that they were first made legal tender at a time when their nominal and real value much more nearly corresponded than they do now. Use and wont have habituated people to the situation, and silver "change" for a \$5 gold piece is given and accepted without thought, and in many cases doubtless without knowledge, that if the silver and gold were both melted the latter would sell for \$5, while the former would bring only \$2.60. Even if silver were to sink to a point much below its present

price, it is unlikely that the general acceptance of our silver coins would be seriously affected. If in the future it should become necessary to lessen the gap between the real and face value of silver coins, which could be done by lowering the denomination or increasing the weight, the many advantages of silver for coinage purposes would in all probability retain it in use.

It may be observed that it is the Government which coins the silver, and stamps it with its nominal value, that profits by the difference, and not at all the miner of the silver, who sells it to the mint for the same price as to any other buyer. That these profits are considerable may be deduced from the fact that in Great Britain the rate of seignorage rose from 9.09 per cent. in 1870, when the average price per standard ounce of silver (925 fine) was 60½d, to 135.29 per cent. in 1913, when the price paid by the Mint had fallen to 28 1/16d. In fact, the gross profit on the coinage of silver by the British Mint of late years has been very great. In 1910 it amounted to £1,582,858, in 1912 to £1,142,538, and in 1913 to £762,926. Silver coins of a value of £1,934,404 were issued by the London Mint in 1913, and of a value of \$1,175,000 by the Canadian Mint in the same year. The estimated face value of Canadian silver coin in circulation in Canada on 31st December, 1913, was \$17,901,031. During that year, it may be noted, foreign silver (mainly of the United States) to the extent of \$2,034,937 was deported by the Finance Department. The advantages possessed by silver as a circulating medium are thus supplemented by the financial benefit which governments all the world over derive from its coinage, and it may therefore readily be assumed that this use will afford a permanent outlet for the metal.

Another unfailing employment of silver, and one which is steadily increasing, is in the arts and manufactures. Solid silver plate, for instance, is not now the mark of luxury, or so far removed from the reach of people of moderate means as it used to be, and in proportion to the decrease in price of an article so generally desired as silver, is likely to be the increase in its use for purposes of this kind.

COBALT.

Cobalt is one of the chief constituents of the silver ores of the Cobalt district. In fact the district owes its name to the abundance of cobalt in the silver ores. It is said that Dr. W. G. Miller put up a sign "Cobalt Station" at Long lake and that the town and lake have been known by that name ever since.

Cobalt is recovered as a by-product in the treatment of the silver ores at the smelters. For the most part it comes into the market in the form of an oxide. It is used chiefly as a coloring agent in pottery manufacture.

Metallic cobalt has recently come into use for electroplating. It resembles nickel, but is somewhat more lustrous. During the past year cobalt anodes for the electroplating industry have been manufactured in Ontario.

Alloys of cobalt, chromium, tungsten and molybdenum make excellent lathe tools. An alloy known as stellite is now being manufactured by the Deloro Mining and Reduction Co. It is much superior to ordinary tool steel.

Mr. T. W. Gibson has recently suggested the use of cobalt for coins. It would make a very attractive coin, superior to nickel. One problem to be met in coining cobalt is to soften it. This may possibly be accomplished by alloying with magnesium.

THE TREATMENT OF COBALT SILVER ORES

Cobalt silver ores have received the attention of many of the best metallurgists. Consisting largely of arsenic, cobalt, nickel and silver they presented many problems to those who first undertook to treat them. At first there was a good price available for cobalt and arsenic and the difficulty of separating the constituents was partially offset by the value of the products. As the production increased, however, the price of cobalt and arsenic decreased, the market for these substances being very limited. Nickel in the ores, instead of being a source of revenue as the original discoverers of niccolite naturally expected, proved to be an undesirable constituent.

At first the ore produced at Cobalt was hand picked and shipped to American smelters. Low grade ore was not treated. Then smelters were established in Ontario at Copper Cliff, Thorold and Deloro and concentrating mills were built at the mines for treating low grade ores. Cyaniding was soon adopted by several companies and finally an amalgamation-cyanidation process for treating high-grade ore was worked out and put into operation at the Nipissing property. A considerable portion of the silver production now leaves Cobalt in the form of bullion. A large proportion of the high grade ore and concentrates goes to Ontario smelters at Thorold and Deloro. Some high grade ore, concentrates and low grade ore is still shipped to United States smelters for treatment.

The Ontario smelters for some time produced chiefly silver, white arsenic and cobalt and nickel oxides. Recently, however, they have been producing metallic cobalt and nickel as well.

During the past year there have been put into operation at Cobalt several experimental plants for the treatment of low grade ore by the oil flotation process. It has been found that a good recovery can be made from tailings carrying a few ounces of silver per ton. As there are many thousands of mill tailings at Cobalt which carry four to eight ounces per ton it is expected that the oil flotation process will be used to advantage. It has been found that the native silver in the tailings is not very readily recovered, but the silver sulphides are. In the tailings much of the silver is present in the form of sulphide minerals.

One difficulty which presents itself to those who adopt the oil flotation process is the disposal of the concentrate produced. The cyanide process gives a product which is melted down at the mine into bullion. The flotation process gives a product which needs to be further treated. Smelting may prove to be the best method of handling the flotation product.

From the results obtained in the experimental cells which have been in operation for some months, two companies concluded to put in a few units of large size. The Buffalo and McKinley-Darragh plants are nearly ready for operation and the results obtained will be of great interest to operators. We will publish in an early number of the Canadian Mining Journal a description of these oil flotation plants.

According to the report of Mr. A. A. Cole, mining engineer of the T. & N. O. Ry., there was milled at Cobalt in 1915, 486,924 tons ore, producing 9,657 tons concentrates. There was treated by cyanide plants 206,858 tons low grade ore, yielding bullion contain-

ing 4,139,918 oz. silver. There was also treated a large quantity of slimes. At the Buffalo and Nipissing high-grade plants there was treated in 1915, 1,472 tons ore and 459 tons concentrate, yielding bullion containing 4,515,448 oz. silver.

According to Mr. Cole's report, 16 per cent. of the silver produced from Cobalt ores in 1915 was from ore treated by U. S. smelters. Southern Ontario smelters yielded 45% of the bullion and plants at Cobalt 39 per cent. The 16 per cent. still going to the United States consists of some high grade ore along with all the low grade material, both ore and concentrates, shipped. The Canadian smelters are not equipped to handle this low grade material. In the high grade mills at Cobalt the silver only is recovered, the cobalt, nickel and arsenic being left in the residue for future treatment or sold for the cobalt content. The Deloro and Thorold smelters are equipped with complete refineries and produce arsenic, cobalt and nickel ready for the market.

WHY HEAVY MINERALS FLOAT.

According to Mr. Geo. D. Van Arsdale, of New York, in a recent bulletin of the American Institute of Mining Engineers, the immediate cause of the main phenomenon of flotation is the resultant of the several surface tensions involved, together with the wetness or non-wetness of the particle, but electrostatics is probably very important as a secondary cause, which may and probably does act in at least two different ways: (1) as one of the causes of wetness or non-wetness; and (2) as one of the possible causes of oil attraction to mineral particles.

"Any substance specifically heavier than water may be made to float by reason of surface tension provided its size be small enough, and provided the particle be non-wet, that is, has a sufficient surface film, which may be either solid, liquid or gas, electrostatic charge, or a combination of these. A non-wet particle in contact with a gas bubble will float while a wet will sink. Hence separation of particles of ore from particles of gangue becomes possible.



COBALT IN 1905

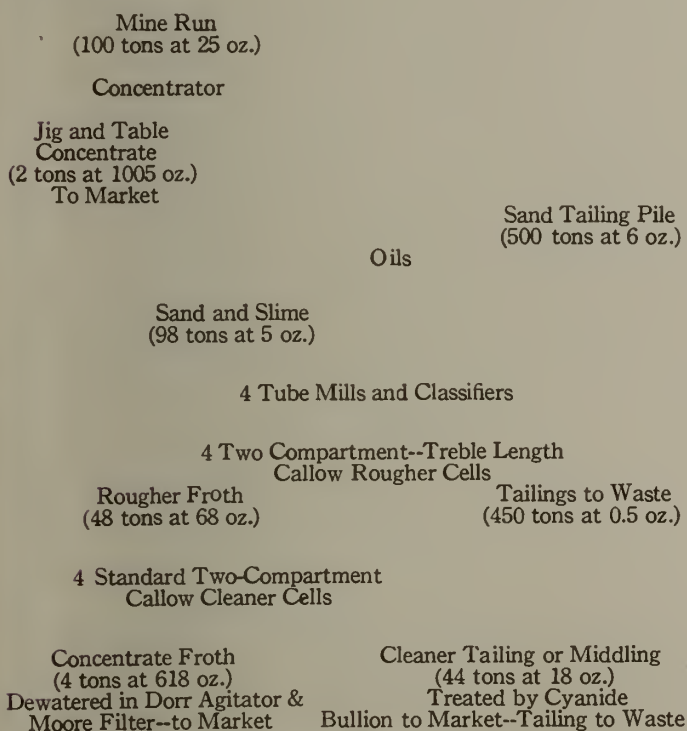
CONCENTRATION OF COBALT SILVER ORES BY OIL FLOTATION*

By A. A. Cole.

The applicability of concentration by oil flotation to Cobalt ores has been demonstrated and a number of companies are now planning oil flotation installations.

The most extensive experimental work has been carried on at the Buffalo mine where a 50-ton plant was put into operation in the fall of 1915 using the Callow Pneumatic Process. The results obtained from this plant were so satisfactory that a larger installation was deemed desirable, and work is now well under way installing a flotation plant to have a daily capacity of 600 tons.

The fine grinding equipment will consist of four 5-ft. 6 in. x 20 ft. 0 in. tube-mills and the flotation equipment will be four, two-compartment, treble length, Callow pneumatic cells used as roughers, followed by four standard two-compartment Callow pneumatic cells used as cleaners. The old cyanide plant will be used for de-watering the flotation concentrate and for the treatment by cyanide of a quantity of flotation middling.



Flow Sheet--Flotation Plant--Buffalo Mines, Ltd.

The process is one which is particularly applicable to the low grade material which makes up the tailing piles of the camp and will make available for treatment immense tonnages of rock which heretofore have been considered of little or no immediate value.

At the Buffalo it is proposed to treat 600 tons daily made up of 100 tons of mine rock and 500 tons of material from the old tailing pile. The mine rock will be run through the concentrator as formerly and the tailing resulting will be sent to tube-mills for further grinding. The 500 tons of material from the tailing pile will be sent directly to tube-mills and the whole product ground to pass 120 mesh. This material after

the addition of suitable oils is sent to the flotation cells where the valuable mineral is floated and collected and the worthless gangue run to waste.

The product collected, containing the silver values, will be run to cleaner cells where a further separation will be made dividing the values into two products, one for shipment and one which will be treated by cyanide on the property.

The tonnages and values in the different products, based upon the experimental work done, will be approximately as indicated in the accompanying flow sheet.

Good results are obtainable by returning the cleaner tailing to the rougher cell. There appears at present to be a decided advantage, however, in treating a small tonnage of a middling by cyanide owing to the slightly greater total recovery and to the saving effected in freight and smelter charges.

Construction is well under way and the plant should be in operation early in the summer of 1916.

The McKinley-Darragh-Savage Company is installing a 200-ton unit for the treatment of current tailing, and several other companies are carrying on flotation experimental work and have plants in contemplation.

NATIONAL MINES.

The old King Edward property on Cross Lake which was formerly operated under lease by the York Ontario Silver Mines, Ltd., is now being developed by the National Mines Co., of Rochester.

COCHRANE.

The Cochrane mine in southeast Coleman, adjoining the Temiskaming, is being unwatered by the Crown Reserve Mining Co. The property was formerly under option to the General Assets Co.

ARSENIC.

Arsenic is one of the chief constituents of the Cobalt silver ores. It is recovered as a by-product and sold as white arsenic, the oxide.

Arsenic is used in glass manufacture. It is said to help remove impurities and also to enter into the glass. Plate-glass factories use large quantities.

White arsenic and arsenate of soda are used in the manufacture of Paris green, lead arsenate and other insecticides.



COBALT IN 1905

*Extract from report to T. & N. O. Ry. Commission.

RECENT DEVELOPMENTS IN THE COBALT DISTRICT

There is now evident at Cobalt a great desire to take up old silver prospects and work them. The Trethewey started work again on the 1st of June and will continue to work regularly from now on. Six drills are running and the mill is treating 100 tons of ore a day. The ore is coming from old stopes in the mine and not much development work is being undertaken. The last annual report of the Trethewey showed that in February of 1915, there was in sight in blocked-out ore 7,139 tons and this, with the broken ore, totalled 11,064 tons. The mine has been kept clear of water and the mill was soon put in shape, so that development could soon be resumed. It is probable that the Trethewey will be a steady producer from this time forward, until the mine is definitely worked out, which may be some time to come, in view of the increased tonnage that the higher price of silver has made profitable.

In the month of May the Nipissing produced \$2,901,898, against \$124,452 in April, or an increase of almost 75 per cent. This production was obtained without drawing upon the main stopes at the Meyer at all. A large portion of the month's production came from development work on vein 490. To date the drifts on the winze level of this vein have developed 225 ft. of 4-in. ore, assaying 1,200 oz. to the ton. Further development will be carried on on vein 490 and the management believes that this will most probably meet with success.

It is satisfactory to note that the orebody found on the north claim of the Nipissing, which has never yielded the company anything before, is showing persistence. The vein was picked up at the second level of the shaft sunk on the O'Brien property, near the Nipissing line and the operations are being carried on at the joint expense of the two companies. The vein now shows on the Nipissing side of the line for a distance of 114 ft. It is singular in that the vein itself is small and usually of low assay, but the adjoining wall rock is so impregnated with silver that the entire width of the drift has an average value of 50 oz. No ore has as yet been taken out of this work.

While the price of silver is still good, old dumps all over the 800 odd acres of the Nipissing are being cleaned up and taken to the central mill. The same applies to the low-grade ore that has been left on the old open cuts on the surface. On Nipissing hill itself the shafts 123 and 86 are being reopened and all the ore in sight taken out. It is the history of all good veins and ore deposits in the camp, that when the final cleaning up is made they produce far more ore than could have been anticipated. All these auxiliary supplies of ore made it possible for the Nipissing to more than maintain production and yet not deplete the main ore reserves hardly at all.

As a commentary on the result of the higher price of silver on Nipissing production, it is to be noted that the Nipissing company received from its own and customs ore during the month of May, \$420,822 from 558,148 oz.; while in March the company received \$322,176 for only 6,227 oz. less, being an increase of almost \$100,000 for a little less silver produced. There is no disposition on the part of either the Nipissing or the other mines in the camp to do more than clean up old dumps while silver is high.

The exception may be at Kerr Lake. This property is maintaining a record production since silver grew

in value. The production from the Kerr Lake mine is being maintained at about 225,000 oz. a month. Of this, 125,000 oz. is very high grade ore, and to-day it may be said that the Kerr Lake is about the only regularly producing mine that is obtaining the majority of its profits from the mining of high grade ore. This is true in normal times. Last month the Nipissing mined more high grade than milling ore, but as a general rule it is true. In the first eight months of their fiscal year, the Kerr Lake Mining Company had produced approximately 1,450,000 oz. With a regular production of 225,000 oz. the gross production for the year will be well over two million and a quarter ounces. This would give a production of about a quarter of a million ounces more than in 1915, but owing to the very much higher value per ounce, the profits will be 25 to 30 per cent. higher at least. At the other end of the scale, it is also to be noted that costs will be down. For the bare mining and hoisting at the mine the company only now pays at the rate of six cents an ounce. While it is quite true that this heavy production is making inroads on the stopes of the Kerr Lake, the much wider extent of the enrichment will admit of the putting in sight of considerably more ore than could have been anticipated when estimates were made by Mr. Livermore last year. Stopes are now being broken through to the surface on the very rich veins found at the bottom of Kerr Lake when the lake was drained. One of these veins was so rich that sufficient ore was taken from one short open cut to pay for the Kerr Lake share of the entire cost of draining the lake. Development and stoping is showing up a remarkable width of low grade ore. One of the stopes on the lake vein is now 80 feet wide on the 140-ft. level, and it is quite possible that the whole of the surface from the 140-ft. level will pay to "Glory Hole."

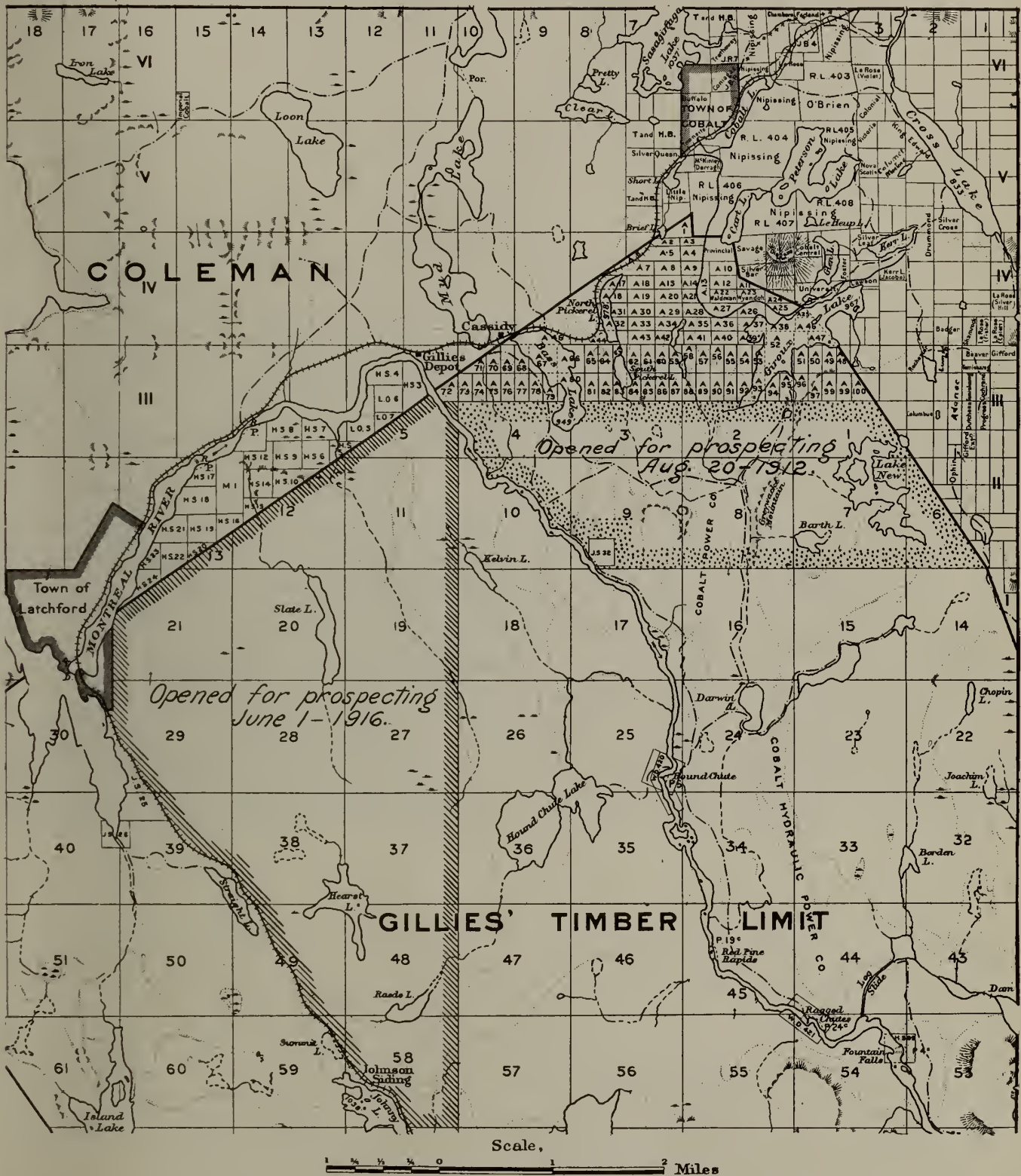
The Kerr Lake Mining Company is also finding that the old Drummond mine, which was purchased from the Caribou Cobalt Mines, is proving a good investment. Last July they bought 837,400 shares of the one million shares issued of the Caribou Cobalt for \$50,000. Since they commenced to operate the property they have only failed to make a profit one month in the year. They have been shipping 25 tons of ore to the Dominion Reduction Company every day, but recently they have been breaking so much mill ore that they have doubled this amount. The new discovery on the hill is now practically stripped of high grade ore, but the mill ore and the wall rock is proving of exceptional width. The Big Chamber is again being stoped out. It was found that at the present price of silver, the "fill" was quite well worth sending to the mill and it is now being taken out. The wall rock has also been tested and several feet more have proved to be profitable to mill and are now being broken down. Occasional patches of high grade ore were also found in the mill rock.

The Kerr Lake Mining Company has pursued the energetic policy of taking up prospects and developing them, during the past year. Apart from the Cobalt Comet they are now working under option the St. Anthony mine in Western Ontario and they still have an option on the Smith-LaBine property at Seseikinika, although they are doing no work on these claims at present. They have recently taken an option on the Maidens property in South Lorrain and have dewatered the shaft and will thoroughly sample. It is con-

tended by the owners that there is a good body of milling ore here, although its existence has never been definitely established before.

Developments in the South Lorrain camp, considering the small amount of work that has been under-

inches of 10,000 oz. ore. It was close to the contact between the Keewatin rocks and the diabase, and it seems most probable that if other prospects were developed along this contact that further ore would be discovered.



taken during the past six years, are distinctly encouraging. Upon the Pittsburg-Lorrain, which company is working the old Curry adjoining the Wettlaufer, there has recently been found a wonderfully rich shoot of ore. The extent of this orebody is, of course, not yet determined, but where it was struck it was four

The Bellellen is now working in a winze about 100 feet below the 150-ft. level, or 275 ft. below the collar of the shaft. In the winze now the vein is 18 in. wide. Silver contents are low, but they are yet a considerable distance above contact and the prospects of them getting into ore lower down are quite good.

The Comfort Leasing and Mining Company is working the Wettlaufer and has already obtained such results that it is certain that they will make handsome profits on their lease. A little encouragement in new ground in the South Lorrain camp would lead many old claim owners to resume operations in this section of the silver field.

Gowganda is in a different category, since transportation is so difficult and tedious. There is not much of real importance to encourage mining men to take up

will be built between the Silver Queen and the Townsite; the Silver Queen to pay two-thirds of the expense and the Townsite, McKinley-Darragh and Right-of-Way to share the other third.

While there has been almost as rapid a decrease in the price of silver as in its rise, there is no lack of confidence in the belief that it will maintain a highly profitable level for operators. During the past three weeks it has shown a drop of between 7 and 8 cents, which is quite material. This drop will affect the pro-



COBALT LAKE AND TOWN, 1911

claims so far back from the railway, over such a vile road. The Miller Lake-O'Brien continues to be the only steadily producing mine in the camp, although the Reeves-Dobie is being worked and several prospects round Calcite lake are active. The Royal Silver mines in Auld Township, near Elk Lake, have taken in two 40 H.P. boilers and a five-drill compressor, to work the silver veins in the diabase. In this township there are quite a number of small veins in the diabase showing native silver, but the poor record of Elk Lake has hindered the introduction of capital in working these deposits.

The Silver Queen Mining Company is now working the old Silver Queen again. The difficulty with regard to water has been settled after a long controversy. Nearly all the mines to the south and west of the town have broken through their party walls, so that broadly speaking when one is flooded all will be more or less flooded, unless some provision were made to segregate them. It has now been arranged that concrete dams

posed sliding scale of wages which the companies had decided to put into force. The men will, of course, get the increase for the month of May, as the average was well over seventy cents, but if the price does not speedily recover, they will certainly not get it in June. There has been some little further dissatisfaction with even the recent increase in wages and as silver will probably show an average of less than seventy cents in June, this will mean that surface workers who are getting from \$2.25 to \$2.75 a day will not receive any benefit from the increase at all. It is quite possible there may be a further adjustment in the wages, as it is recognized that the cost of living has gone up very considerably.

ROGNON GOLD MINES, LTD.

The corporate name of Laurentian Consolidated Mines, Ltd., has been changed to Rognon Gold Mines, Ltd.

FLINFLON LAKE DISTRICT

In the summary report of the Geological Survey for the year 1915 Mr. E. L. Bruce says of the deposits at Flinflon lake, examined by him in 1915:

"Late in the summer of 1915 discoveries of mixed sulphides were made at Flinflon lake and much staking and some development work have been done. The canoe route to this lake leaves the north arm of Athapapuskow by way of Trout creek which is ascended to Schist lake. At the north end of the long arm that trends a little west of north is a large creek. This is ascended to a lake from which a portage leads south-west to a smaller lake, and from this a portage leads into Flinflon lake. Only a brief visit was made late in the season.

"On the original claims, which are along the east side of the lake near the south end, cross trenching has been done, but as the ore is near water-level it has been difficult to get down to solid sulphides and at the time the claims were visited the trenches were filled with water with knobs of sulphides showing above it. The trend of the ore zone is northeast and southwest and in the main trenches the surface width is nearly 200 feet. Four hundred and fifty feet south of this, it has again been trenched across showing the same width. Between these two series of trenches, there is, however, an elliptical horse of unmineralized rock 50 feet in width. The sulphides have also been found in trenches north of this main mass. Inland the land is low and solid rock has not been reached east of the sulphide zone and hence its attitude is unknown. The western part of the zone consists of pyrite. Eastward across the vein this gives place to banded pyrite, sphalerite, and galena, while the eastern part exposed shows considerable chalcopyrite. The banded ore has a dip of 45 degrees to the east. There is no quartz present.

"The country rock of this district consists of ancient volcanic rocks—greenstones, pyroclastics, and autoclastics, some bands of later conglomerates, and intrusions of quartz porphyries which are probably genetically related to the ore deposition. These porphyries are believed to be connected with the granitic batholiths that lie within a few miles of the district. No careful sampling of the deposit was possible and the amount of development is not sufficient to show whether or not the values are high enough to bear the cost of treating a smelting ore."

Since Mr. Bruce's visit much diamond drilling has been done and the existence of a very large body of ore has been proven. Exploration is progressing with very encouraging results.

THE PAS MINING DISTRICT

The Pas, Manitoba, June 2.—The mining headquarters of the northland will be established in The Pas is the word Mr. F. H. Kitto brought here yesterday from Controller Rowatt, of the mining lands and Yukon branch of the Department of the Interior. Mr. Kitto is here to also fix the location of Flinflon and determine in which province it lies. He informed the Herald that the department were fully cognizant of the development taking place here, and every aid would be extended by the Government.

The importance of making The Pas the mining office for this district has been emphasized by many organizations, and now that the matter is decided, it will cause a general feeling of appreciation among mining men and prospectors. It was a much needed improve-

ment, and the Dominion Government are to be congratulated for taking the step.

The details are being worked out, said Mr. Kitto, and it will take some little time to arrange a transfer of the records now in the offices at Dauphin, Prince Albert and Winnipeg, but as soon as this was in readiness the change would be effected. He mentioned also that the new district would be known as The Pas Mining District, and would include all the mining areas of Beaver, Flinflon, Schist and Herb lakes. The documents and records of all mining claims and mining transactions made in the district would be kept in the new office, he said.

G. S. Scott, of the Coniagas smelter, of Thorold, Ontario, returned from a three months' examination of the orebody at Flinflon and Schist lakes on Friday. Mr. Scott said he was quite pleased with his observations and he thought the Hammell properties would develop into a mine. He likes the appearance of the ore, and the size of the body greatly impressed him. Joe Metcalfe and Jack Bridges also came by the same boat from Flinflon. Mr. Bridges said the drills at Flinflon were on their tenth set of holes, and he understood that the contract was half completed. The first 65-degree holes were being drilled as the party left the camp, it was stated. The ice in all the lakes has disappeared.

Frank Stanley is down from Herb lake, and he reports a strike of a 4-foot quartz vein on Little Herb lake. Henry McCafferty and Bob Hassett are the finders, said Mr. Stanley.

A syndicate to control a bunch of claims at Piquitona was formed on Saturday. The members are Messrs. Masterson, Young, Ridyard, Spring, Long, Robbie, Lovell, Ocumpaugh and others.

Messrs. Kerr and Nash got out from Herb lake on Monday. They spent two weeks studying the ore strikes. Mr. Nash is acting for the Alaska-Gastineau Gold Mining Co., and he will make a report to his company on his trip into Mike Hackett's stamping ground. Kerr owns nearly half the claims at Herb lake, and he is anxious to get something started up there.

A group of claims have been staked at Mile 191, Hudson's Bay railway, for silver. The claims are two miles from the track, and were located by O. C. Ocumpaugh. Whatever knowledge the locator has about the values, he is keeping it to himself.

R. W. Brooks, of Flinflon, paddled down from the north on Tuesday night. Mr. Brooks is the engineer in charge of the mines.—The Pas Herald.

KAMISKOTIA MINING CO.

The Kamiskotia Mining Co. has been incorporated under the laws of Ontario. The provisional directors are Henry H. Shaver, John McKay Macbeth, and James Parker, barristers, and J. C. Thomson and J. G. Hamilton, students-at-law, all of Toronto.

GOLD DISCOVERY IN GAUTHIER.

Rich specimens of gold ore from the Elstone claims in Gauthier, about two miles east of the Lebel line and two miles north of the McElroy line, have been brought to Toronto.

KOWKASH.

Mr. P. E. Hopkins of the Ontario Bureau of Mines has proceeded from Toronto to Kowkash to continue geological mapping of that district. Kowkash is now a mining district and M. R. Morgan has been appointed recorder.

PERSONAL AND GENERAL

Prof. Wm. Nicol of Queens University, has resigned as Professor of Mineralogy, a position which he has held since the School of Mining was founded, in 1893.

Mr. Alfred H. Brooks, geologist in charge of the Alaska investigations, will be engaged in office work in Washington till the middle of June, when he expects to start for Alaska to visit the Nome, Ruby, and Juneau districts. He probably will not return to Washington till early in October.

Mr. P. E. Hopkins, of the geological staff of the Ontario Bureau of Mines, is at Kowkash in charge of a party mapping the area.

Mr. A. G. Burrows, of the geological staff of the Ontario Bureau of Mines, has completed a preliminary report on the Boston Creek gold area.

Mr. Alex. Longwell has returned to Toronto after visiting gold mines at Porcupine.

Mr. Geo. Guess, Professor of Metallurgy at the University of Toronto, has been engaged by the Vermont Copper Co. to start up the copper smelter at South Strafford, Orange Co., Vermont. Prof. Guess left Toronto last week to take charge of operations. The furnace has not been operated successfully. Semi-pyritic smelting was tried, but abandoned in 1908.

Mr. Charles O'Connell, who has recently taken up again his work as manager of the Tough-Oakes mine after some months' holiday for his health, was in Toronto last week.

Mr. Jack Hammel is in Toronto. Owing to the illness of Mrs. Hammel he has postponed his visit to this property at Flinflon lake which is being developed under option by Hayden & Stone Co.

Mr. A. B. Clabon is in Toronto.

Mr. C. A. Foster was in Toronto last week.

Mr. Ben Hollinger, who has made a gold discovery at Boston Creek, was in Toronto last week.

Mr. G. S. Scott is at The Pas.

Mr. W. J. Porter, of Victoria, B.C., who some years ago was active in the development of mining properties near Phoenix, Boundary district, has been engaged by the Granby Consolidated Co. to take charge of development work on one of the islands along the coast of British Columbia.

Mr. Arthur Lakes, Jr., for a year or two superintendent of the Wilcox mine, in Ymir camp, Nelson division of British Columbia, on his recent return from Alaska, whence he went to examine mining properties, visited his father, Prof. Arthur Lakes, at Nelson, B.C.

Mr. James McGregor, inspector of mines in West Kootenay and Boundary districts of British Columbia, has been granted three months' leave of absence, during which Mr. H. H. Johnston, a well-known underground official in the Consolidated Mining and Smelting Co.'s Centre Star group of mines, Rossland, will be his locum tenens.

Mr. George Watkin Evans, coal geologist, of Seattle, Washington, who several years ago did a season's field work in the Groundhog coal field in the northern Skeena country, British Columbia, and has done much geological work in the Northwestern States and Alaska, has been spending a few days on Vancouver island, B.C. He will shortly proceed to Alaska to again undertake investigations for the United States Bureau of Mines.

Mr. Charles Graham, superintendent for the Corbin Coal and Coke Co., operating in the Crowsnest district, Southeast Kootenay, British Columbia, was at Nanaimo and Victoria for several days about the end of May.

Mr. Thomas Graham, chief inspector of mines for British Columbia, left Victoria on June 2nd for Joplin, Missouri, where he will attend the annual meeting of the American Mine Inspectors' Institute, of which he has been first vice-president during the year now closing. He will be absent from Victoria until the beginning of July.

Mr. J. F. C. B. Vance, of the Dominion of Canada Assay Office, Vancouver, B.C., has obtained a commission as a lieutenant in the 11th Regiment (Irish Fusiliers of Canada).

Lieut. (supernumerary) O. E. LeRoy, of the 72nd Regiment, has been confirmed in his rank. He was recently successful in passing an examination in Victoria, B.C., for the rank of captain.

Mr. A. H. Gracey, for several years manager of the Athabasca-Venus Gold Mines, near Nelson, B.C., is now at Oatman, Arizona.

Mr. Albert I. Goodell, a metallurgist well known in the Northwest, has been appointed ore buyer for the British Columbia Copper Co., with smelting works at Greenwood, Boundary district.

Mr. Henry Clark, representative of the Head, Wrightson Co., mining machinery manufacturers, England, has returned to Victoria, B.C., from Japan.

On May 25th the Daily Colonist, Victoria, B.C., published the following information: "Recognizing the need of men for war service, Prof. Stuart J. Schofield, M.A., Ph.D., head of the Department of Geology at the University of British Columbia, has enlisted in the ranks of the British Columbia company of the Western Universities Battalion as a private. He joined last Tuesday with the splendid aggregation of collegians who are going to do their 'bit.' His example will no doubt give a big stimulus to recruiting for this distinctive unit which is now rapidly nearing its complete strength of 250. Nearly 200 have already enlisted. Professor Schofield has had a noteworthy career. Before joining the staff of the university he was with the Dominion Geological Survey and conducted a number of important surveys. A graduate of Queen's University, he secured honors at other educational institutions, including the Boston School of Technology. He held a commission in the 3rd Field Company of the Canadian Engineers while resident in Ottawa before coming to the Pacific coast."

Mr. Samuel W. Cohen, general manager of the Crown Reserve Mining Company, Limited, and the Porcupine-Crown Mines, Limited, has returned to Cobalt after a two months' examination trip through Idaho, Oregon and California.

The Jeffrey Manufacturing Company of Columbus, Ohio, announce the reopening of their northwestern branch office at Seattle, Wash., and the appointment of Mr. Percy E. Wright, consulting mechanical engineer, as district manager for Oregon, Washington, Alaska, British Columbia and Alberta.

CALUMET AND MONTANA MINE, COBALT.

Cobalt, June 10.

The new head-frame and ore house at the Calumet and Montana Consolidated was completed last week and mining operations are now under full swing again. The company began hoisting ore on Tuesday last for the first time, while the ore bin was being completed and as soon as possible a shipment will be made ready. All of the ore will have to be handpicked for high-grade, while the milling rock will be sent to one of the local concentrators.

NOVA SCOTIA

Renewal of P. W. A. Agreement with Dominion Coal Co.—The long-standing wage agreement between the Provincial Workmen's Association and the Dominion Coal Co. has been once again renewed. The agreement would ordinarily have expired at the close of 1916, but the unusual conditions brought about by the war, particularly the increased cost of living, caused the anticipation of the usual negotiations. The new agreement provides for an increase in all mining rates and day wages at the mines of six per cent., effective at the first of June, to be followed by a further increase of four per cent., making ten per cent. increase on the rates paid in May, effective at the first of January, 1917; the agreement being renewed and extended for a further two years, or to the end of 1918.

The history of this wage agreement is unique in the labor annals of Canada. The first wage agreement contracted between the P.W.A. and the Coal Co. dated from the beginning of 1905 for a period of three years. Upon the expiry of the agreement at the end of 1907, certain adjustments in rates were scheduled by the Coal Co. which were objected to by the workmen, and a Board of Conciliation was called under the chairmanship of Prof. Adam Shortt. The award of this board made certain modifications in the published schedule, and in all other particulars carried forward the understanding of the so-called Three Years' Contract of 1904. The Shortt award has been renewed on subsequent occasions in 1909, 1911, 1913 and now again in 1916, so that the present renewal, carrying the agreement as it does until the end of 1918, links up a continuous agreement covering a period of fourteen years, during which long term of years the two parties to the agreement have loyally kept faith with each other. The present willingness of the Coal Co. to anticipate the expiry of the 1913 renewal by seven months, and to grant a substantial increase in wages, under the existing difficult and uncertain conditions of the coal trade, is proof of the good understanding that exists between the company and its workmen. During the fourteen years referred to the rate of wages for unskilled mine labor has increased from \$1.32 per day paid in 1904 to \$1.80 from the 1st of June, 1916, and will increase still further to \$1.87 per day in January, 1917.

The Dominion Coal Co. at the present time is operating under two grave handicaps, namely, a decrease in outputs due to shortage of labor caused by recruiting, and a most serious shortage of vessels to carry coal to market.

The production of the company's collieries, operating to full capacity of the available workers, was in May this year 90,000 tons below the production of May, 1915, and indications point to a further reduction in production.

Notwithstanding the drop in outputs the available freighting tonnage will not suffice to transport to a market even the reduced production of the mines, and unless the authorities can be prevailed upon to release for the coal-carrying trade the vessels now under Admiralty requisition, it will result in the partial idleness of the collieries at an early date, and it may even force the temporary closing down of certain collieries. With the exception of the requirements of the steel companies and local bunker sales, the coal trade of Cape Breton is entirely an export business, and it is quite evident that if freighting vessels are not obtainable there is no outlet for the coal production, which must

necessarily be reduced in proportion to the shortage in carrying tonnage.

The shortage of vessels may also restrict the coal requirements of the steel companies. The raw materials for steel making, with the exception of coal, have all to be assembled by water, the iron ore coming from Newfoundland, and the limestone from the interior of the Bras d'Or Lakes. It is necessary, because of the climatic conditions, to stock sufficient limestone and ore at the steel plants during the summer to last until the disappearance of the drift ice in the spring, this being usually about the middle of May. If stocks are insufficient to last through the winter, steel manufacture must be restricted, or cease entirely. In such an event the consumption of coal will be affected.

The need of ships for Admiralty purposes is undoubted, and may be imperative. But the need for coal and steel is fully as imperative. The unique nature of the Cape Breton coal-trade consists in the fact that the principal market for Cape Breton coal is inaccessible during six months in each year. It is therefore necessary to compress the requirements of twelve months into half that time, and unless shipping commences promptly and in heavy quantity immediately the ice has gone, the lost time cannot be regained. The gravity of the present situation will disclose itself very unmistakably next autumn, but it will then be too late to remedy the shortage which will have accrued, in production, and in transportation to market.

The "Colliery Guardian," in a recent editorial, remarked that: "Only Germany so far seems to have realized that success in modern warfare is limited to ability to produce and carbonize bituminous coal." This sentence crystallizes well informed opinion on the status of coal in the present war. Your correspondent has for a long time past endeavored to point out that 1916 will see in Eastern Canada a considerable diminution in the production of bituminous coal, the one basic, paramount, and indispensable munition of war, the substance which enables the soldier to go to the front and provides all his weapons of offence. There is every reason to suppose that the production of bituminous coal in Eastern Canada will in 1916 be two million tons below the capacity of the collieries. If success in modern warfare really does depend on the production of bituminous coal—and the more this dictum is considered and pondered over the truer it will be found to be—the reduction in the output of coal in Nova Scotia is more than a question of the dividends of the coal companies, or the ability of the miners to earn wages that will give them the necessities of life, or the supply of coal in Montreal next winter; it is a matter of national import. The manufacture of munitions in Canada, the enormous necessary expenditures on military matters, and the million and one expenses arising out of the war, are being paid for by borrowed money. Would it not be just as well to mine two million tons of coal in Canada as to buy the coal from the United States? Two million tons of coal to-day should easily be worth ten million dollars, and that is ten per cent. of the Canadian Government War Loan, on the raising of which we so plumed ourselves a little while ago.

A prominent mining man, who visited Belgium shortly before the war, has expressed the opinion that the Germans in their initial burst through Belgium did not expect to take Paris, but that their operations were really conceived with the idea of occupying and exploiting the coal fields of Belgium and the iron ore deposits of Lorraine.

Protests against injustice to particular industries or localities are always open to the accusation of special pleading or particularism. Enquiry will show, however, that nothing has been accounted of more paramount importance in the economic councils of the Allies than this particular question of the maintenance of the coal supply. The Government of Canada would have excellent precedent if they decided to appoint a Royal Commission to enquire into the reduction of the production of bituminous coal in Nova Scotia.

PORCUPINE, KIRKLAND LAKE AND BOSTON CREEK

While the construction work at the two big mines of the Porcupine camp continues to absorb most attention, the developments on the McIntyre and the West Dome have the most interest for the outside world. While the shareholders of the McIntyre have not yet received the annual reports, statements containing some statistics have been given to the press, and from these it is seen that the first reports of the discoveries on the McIntyre were not exaggerated. The orebody on the 700-ft. level, it is true, was shallow, but the extent of it at that level and for 30 or 40 feet below it made great compensation. The 1,000-ft. level is also responding to development. Beyond the 25-ft. orebody first cut, there has now been opened up another wide orebody through the first long crosscut from the McIntyre Extension shaft to the No. 5 shaft. The heads to the McIntyre mill are running very high and the production during the months of May and June will be far above normal. The Jupiter is now producing regularly and 75 tons of ore a day is being sent to the McIntyre over the surface tramway. This ore is weighed and carefully sampled, before it leaves the Jupiter rock house, and it is mixed with the McIntyre ore to be treated.

Surface developments at the Hollinger, in the prosecution of their work for the extension of the mill, are proceeding apace; although there is some difficulty experienced in getting surface labor. It is a fact that there is not yet any great scarcity of skilled labor, either underground or on the surface, at Porcupine, but there is a very decided shortage of unskilled labor, both in the regular work of the mine and for additional construction. Many of the foreigners who were in the camp last year have gone to the United States and operations have so increased that the existing supply is barely sufficient to meet the needs.

Additional energy will be given to the controversy between the exponents of ball mills for first crushing and adherents of stamps, by the decision of the Dome to throw out all their stamps and put in three more large ball mills. This is the most interesting since at the other end of the camp the Hollinger was as emphatic in upholding the merits of the stamps, when they decided to install 100 more stamps, after tests with ball mills. The Dome already have two ball mills installed, but only one of them is at present treating ore. The other will be this month.

The Dome record for the month is easily the best that they have ever attained. The production was 39,300 tons for the month of May and the grade took a sudden rise after the low point obtained in April. The result was that the increase of bullion was the most material for many months. Another most satisfactory feature is that costs are still kept down. While they ran \$2.46 per ton, or five cents more than the pre-

vious month, it is to be noticed that milling showed a decrease of three cents a ton and is now down at the record low cost for the camp of seventy-two cents a ton. The Dome is still handicapped by the fact that they cannot reach their stopes on the sixth and seventh levels and nearly all the ore from the higher grade orebodies that is going to the mill is still from development. Of the 39,300 tons sent to the mill, over 26,000 still comes from the open pits on the surface.

The central shaft is itself now finished to below the 700-ft. level and the steel head-frame is well advanced towards completion, but the hoist for the man-way cage has not yet arrived and according to advices may be delayed for some time yet. The hoists for the ore cages are on the ground and will be installed at once.

Continued success is being obtained with the diamond drill on the West Dome Consolidated. Following the success obtained in the No. 1 hole, four more veins have been cut in the No. 2 hole with the diamond drill, above the 950-ft. level, or 700 ft. vertical. The three first veins to be cut were much lower grade than that found in the first hole put down. They run from \$7.50 to \$8.60 a ton and average from five to six feet wide, but the fourth vein cut showed far more mineralization than the others and will undoubtedly run much higher. It is at least 10 ft. wide. As far as can be ascertained this latter orebody will be a continuation of the ore cut in the No. 1 hole. The shaft is being continued down to the 300-ft. level and the vein still shows a reassuring amount of free gold; although it is still comparatively narrow. The other drill hole sunk on the north side of Edwards lake had not opened up any ore of any value for as far as the 1,000-ft. level.

The discovery of some high grade ore in a small quartz vein on the Hollinger property adjoining the McCrea claims at Boston Creek, has aroused very much interest. This is due not only to the surface value of the discovery, but to the fact that Benny Hollinger has once again found gold in the new district, and that this is something new. The discovery was made by Paddy Barrie, one of Hollinger's partners. He had left work on a much larger quartz vein, to do a little prospecting and in pulling the moss off this quartz vein on the side of a hill, he suddenly discovered some remarkably rich ore. This vein apparently has strength and persistence, since it has been traced for several hundred feet on the neighboring property of the O'Donald. There is no doubt that active operations will be conducted on both these properties at once.

Of far more actual importance, although not attracting so much attention, is the discovery of very rich ore below the 100-ft. level of the R. A. P. Syndicate. The R. A. P. Syndicate is sinking from the 100 to the 200-ft. level, and ran into about a foot of very high grade ore in their shaft. There is much free gold and fine sulphides in a blue quartz and the gold exists in considerable quantities in the wall rock. A drill is also being run in the east drift of the 100-ft. level and results are most reassuring. There is now in the face about two feet of high grade ore and the zone of enrichment is probably $4\frac{1}{2}$ ft. wide.

At Kirkland Lake, the Lake Shore has opened up a patch of very high grade ore on the 300-ft. level. This patch of ore is extraordinarily rich in altaite, and there is almost as much free gold as in the Tough-Oakes ore. There is now about 400 ft. of ore developed at the 300-ft. level of the Lake Shore, and the mine is now most promising.

Prospects in Kirkland Lake are being held up by lack of any definiteness in the power situation. In the

spring several companies were organized to develop small water powers in the neighborhood. It was found that these water powers would develop such limited horse-power that they could not take care of all the properties then in sight. The project was dropped and the Northern Ontario Light and Power Company canvassed the district with regard to obtaining contracts from companies, if they decided to put in power. The plan to use the surplus power now available in the Cobalt camp for Kirkland Lake and district, by extending the transmission lines, has been fully outlined before, but owing to the cost and difficulty of obtaining supplies of copper and other material, nothing further has been done, beyond buying the poles and negotiating for right-of-way. It is not possible that the power can be delivered into Kirkland Lake or Boston Creek now, until the fall is far advanced. This is unfortunate for the Teck-Hughes Mining Company, which now has a completed mill which cannot very well be used until electric power is available in the camp.

BRITISH COLUMBIA

WEST KOOTENAY.

Ainsworth.—Shipment of ore was resumed several weeks ago by the Florence Co. and the Highland mine. The Utica, in the western part of the division, continues to send out a carload of silver-lead ore every two or three weeks. A new mine on the producing list is the Comfort, situated near the Bluebell, on the eastern side of Kootenay lake, from which property 25 tons of ore was received at Trail in May. The Lucky Jim is reported to be making headway, and obtaining a profit on its mining operations so that its liabilities are being reduced.

Slocan.—The Rambler-Cariboo and the Ruth-Hope, in central Slocan, and the Galena Farm, Hewitt and Standard are maintaining ore shipments from the mining region in the neighborhood of Silverton, Slocan lake. The year's shipping list to date includes the names of sixteen mines, but only three or four of these have shipped more than 500 tons of silver-lead ore this year. The Standard is in the lead, with a total to the end of May of about 3,500 tons shipped to Trail; the Rambler-Cariboo is next with about 700 tons. Both these mines also shipped zinc ore, which was sent to United States smelting works.

OMINECA.

A newspaper report of an interview with Mr. Morley Donaldson, vice-president and general manager of the Grand Trunk Pacific Railway Co., included several allusions to mining in Western Canada. Referring to matters particularly affecting the British Columbia end of the company's railway he is reported to have said that the exploration work being done in connection with mining is very much greater than the public supposes is the case. He said, further: "At a number of railway stations I noticed piles of ore sacks brought in from distant places by prospectors who are opening mining properties and sending bulk samples of ore for test purposes to smelting works. In addition, I found that from one mine near Hazelton about 3,000 tons of copper ore is being shipped monthly, and a vessel at Prince Rupert was being loaded with 1,000 tons of this ore while I was there." Mr. Donaldson also said: "In Alberta mining is developing to a remarkable extent, and our company has decided to this season utilize in Winnipeg coal from that province. We have not made any purchase of American coal this year, and if the

best of our western coal shall prove a success it will give these coal mines and towns a busy future."

The ore alluded to by Mr. Donaldson was that being shipped by the Rocher Deboule Mining Co., for late in May the barge Baroda, loaded with 1,800 tons of copper ore from the Rocher Deboule mine, in the Hazelton region, was towed from Prince Rupert to Tacoma. The intention was to ship only 1,000 tons on the Baroda, but there was delay in getting a tug to tow the barge south, so as the ore was accumulating to such an extent as to hinder progress, the larger quantity was put on the scow and the congestion relieved to that extent. Prior to commencing to ship ore to the smelting works near Tacoma, Puget sound, Washington, the Montana Continental Development Co., which then had a lease of the Rocher Deboule Co.'s mine, in the second half of last year shipped to the Granby Consolidated Co.'s smelting works at Anyox, Observatory inlet, about 17,000 tons of ore which contained an average of 8 per cent. copper and small value in gold and silver.

GENERAL NOTES.

The development of the Sunshine group of mineral claims at Uchucklesit harbor, on the west coast of Vancouver island, has been resumed. It is expected that small shipments of copper ore will be made during the ensuing summer.

Meetings of the Western Branch of the Canadian Mining Institute are to be held at Sandon, Central Slocan, and Silverton, Slocan lake, during the latter part of June. There is much mining activity in the neighborhood of both Sandon and Silverton, so the decision to hold meetings at those places at this time is regarded with satisfaction in the district.

The W. R. Grace steamer "Colusa," which late last month arrived on the British Columbia coast from South American ports, after discharging 2,400 tons of nitrates at the James Island works of the Canadian Explosives, Ltd., proceeded to Tacoma, Puget sound, Washington, with the remainder of her cargo, the greater part of which consisted of ore for the Tacoma smelting works. Years ago ore from the Mexican coast and places farther south used to be received occasionally at the Tyee Copper Co.'s smeltery on Vancouver island.

FLIN FLON.

Drilling at Flinflon lake is proving up an enormous body of ore of good grade.

SILVER PRICES.

	New York.	London.
	cents.	pence.
May—		
23.	71½	34½
24.	71½	34½
25.	71½	34½
26.	71½	34½
27.	71½	34½
29.	70½	33¾
30.	holiday	32½
31.	68¾	32½
June—		
1.	68¾	32½
2.	64½	31
3.	64¾	31
5.	66½	31¾
6.	66½	31½
7.	66½	31½
8.	66½	31½
9.	62¾	30

MARKETS

STOCK QUOTATIONS.

(J. P. Bickell & Co., Toronto.)

As of close June 8, 1916.

New York Curb.

	Bid.	Ask.
Atlantic Steel	60.00	62.50
Atla. Cons.	60.00	63.00
Butte.	6.87	7.00
Can. Car	69.00	70.00
Curtiss Aeroplane	48.00	50.00
Chevrolet.	2.45	2.48
Can. Copper	2.00	2.12
Chandler Motors	117.50	119.00
Chalmers.	220.00	250.00
Cambria Steel	81.00	85.00
Canada Cement	71.00	71.25
Emma Copper	60.00	65.00
First National	4.50	4.75
H. & B. Car	34.00	35.50
Howe Sound	5.00	5.25
International Petroleum	10.50	10.75
Inter. Nickel (New)	45.37	45.50
Kennecott Copper	53.25	53.37
Maxim Munitions	7.00	7.25
Midvale Steel	64.87	70.00
Marconi.	3.00	3.12
Magna.	15.00	15.50
Mother Lode	25.00	26.00
Steel of Canada	62.25	62.50
Steel & Radiation	38.00	41.00
Submarine Boat	37.00	37.50
Tonopah Extension	6.00	6.12
U. S. Light	3.75	7.00
White Motors	59.00	59.50

Porcupine Stocks.

	Bid.	Ask.
Apex.	.08	.08½
Dome Consolidated	.12	.15
Dome Extension	.32½	.33
Dome Lake	.30½	.31
Dome Mines	26.75	28.00
Eldorado. ....	....	.00½
Foley O'Brien	.51	....
Gold Reef	.01½	.01¾
Hollinger	29.50	30.10
Homestakes.	.50	.55
Jupiter.	.35	.35¾
McIntyre.	1.74	1.75
McIntyre Extension	.53	.54½
Moneta.	.13½	.14
Porcupine Crown	.93	.95
Porcupine Imperial	.03½	.03¾
Porcupine Tisdale	.01¾	.02
Porcupine Vipond	.58	.60
Preston East Dome	.04½	.05¼
Teck Hughes	.20	.22
West Dome Consd.	.37¼	.37½

Cobalt Stocks.

	Bid.	Ask.
Adanac.	.61	.63
Bailey.	.08	.08¼
Beaver.	.40	.42
Chambers Ferland	.24	.24¾
Coniagas.	5.00	5.25
Crown Reserve	.50	.51
Foster.	.09	.09½
Gifford.	.06½	.07
Gould.	.00¼	.00½

Great Northern .....	....	.06
Hargraves.	.03½	.04½
Hudson Bay	35.00	....
Kerr Lake	.04½	.04¾
La Rose	.65	.70
McKinley.	.60	.62
Nipissing.	7.25	7.40
Ophir.	.08	.08¾
Peterson Lake	2.66	2.72
Right of Way	.04¾	.05½
Rochester. ....	....	.06½
Seneca Superior	.23	....
Silver Leaf	.02	.02¼
Temiskaming	.64	.65
Trethewey.	.22	.25
York Ontario	.01	.01¾
Wettlaufer.	.07½	.09

NEW YORK MARKETS.

June 9, 1916—Connellsville Coke—

Furnace, spot, \$2.75.

Contract, nominal, \$2.50 to \$2.75.

Foundry, prompt, \$3.25 to \$3.50.

Contract, \$3.50.

June 9, 1916—Straits, Tin, nominal, 44.75 cents.

Copper—

Prime Lake, nominal, 27.75 to 28.25 cents.

Electrolytic, nominal, 27.75 to 28.25 cents.

Casting, nominal, 25.75 to 26.00 cents.

Lead, Trust price, 7.00 cents.

Lead, outside, 6.85 to 6.95 cents.

Spelter, prompt western shipment, 13.80 to 14.05 cents.

Antimony—

Chinese and Japanese, 21.50 to 22.50 cents.

American, 21.50 to 22.50 cents.

Aluminum, nominal—

No. 1 Virgin, 98-99 per cent., 60.00 to 62.00 cents.

Pure, 98-99 per cent. remelt, 58.00 to 60.00 cents.

No. 12 alloy remelt, 48.00 to 50.00 cents.

Nickel, 45.00 to 50.00 cents.

Cadmium, nominal, \$1.25 to \$1.50.

Quicksilver, nominal, \$70.00.

Platinum—nominal, \$78.00.

Cobalt (metallic), \$1.25.

Silver (official), 62.75 cents.

Metal Products—Following base prices are all f.o.b. mill:

Sheet Copper, hot rolled, 37.50 cents.

Sheet copper, cold rolled, 38.50 cents.

Copper wire, 31.50 to 32.00 cents.

High sheet brass, 38.00 to 39.00 cents.

Seamless brass tubing, 43.00 to 44.00 cents.

Seamless copper tubing, 43.50 cents.

Brazed brass tubing, 45.50 to 46.50 cents.

Brass wire, 38.00 to 39.00 cents.

Brass rods, 38.00 to 39.00 cents.

Sheet zinc, f.o.b. smelter, 21.00 cents.

TORONTO MARKETS.

June 12—(Quotations from Canada Metal Co., Toronto)—

Spelter, 20 cents per lb.

Lead, 9 cents per lb.

Tin, 52 cents per lb.

Antimony, 35 cents per lb.

Copper, casting, 30 cents per lb.

Electrolytic, 31½ cents per lb.

Ingot brass, yellow, 16 cents; red, 21 cents per lb.

June 9—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, \$8 per ton.

Coal, bituminous, \$5.75 per ton.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Diamond Drill Contracting
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Smith and Travers.
Sullivan Machinery Co.

Dredging Machinery—
M. Beatty & Sons.

Dredging Ropes—
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ada, Limited.

Drills, Air and Hammer—
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Northern Canada Supply Co.

Drills—Core—
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Drills—Diamond—
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Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.

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Can. Ingersoll-Rand Co., Ltd.

Engines—Marine—
Smart-Turner Machine Co.

Engines—Steam—
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Smart-Turner Machine Co.
M. Beatty & Sons.

Fans—Ventilating—
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Jeffrey Mfg. Co.

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ada, Limited.

Flights—
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Lyman, Ltd.

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Northern Canada Supply Co.

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Northern Canada Supply Co.

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Co. of Canada, Ltd.

Hand Hoists—
Darling Bros., Ltd.
Fraser & Chalmers of Can-
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High Speed Steel Twist Drills—
Northern Canada Supply Co.

**Hoists—Air, Electric and
Steam—**
Can. Ingersoll-Rand Co., Ltd.
Jones & Glassco.
M. Beatty & Sons.
Fraser & Chalmers of Can-
ada, Limited.
Northern Canada Supply Co.

Hoisting Engines—
Sullivan Machinery Co.
Fraser & Chalmers of Can-
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Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hose—
Northern Canada Supply Co.

Insulating Compounds—
Standard Underground Ca-
ble Co. of Can., Ltd.

Jacks—
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

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Geo. G. Blackwell, Sons &
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Canada Metal Co.
C. L. Constant Co.

Monel Metal—
International Nickel Co.

Nickel—
International Nickel Co.

Ore Sacks—
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Ore Testing Works
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Geo. G. Blackwell.
Consolidated Mining and
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Orford Copper Co.
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Northern Canada Supply Co.
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Pipe Fittings—
Northern Canada Supply Co.

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Jones & Glassco.

**Prospecting Mills and Mach-
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Standard Diamond Drill Co.
Fraser & Chalmers of Can-
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Pumps—Boiler Feed— Darling Bros., Ltd. Smart-Turner Machine Co. Northern Canada Supply Co. Canadian Ingersoll-Rand Co. Ltd. Fraser & Chalmers of Canada, Limited	Pumps—Vacuum— Darling Bros., Ltd. Smart-Turner Machine Co.	Screens—Cross Patent Flanged Lip— Hendrick Mfg Co.	Steel—Tool— N. S. Steel & Coal Co.
Pumps—Centrifugal— Darling Bros., Ltd. Smart-Turner Machine Co. M. Beatty & Sons. Can. Ingersoll-Rand Co., Ltd. Fraser & Chalmers of Canada, Limited	Quarrying Machinery— Sullivan Machinery Co. Can. Ingersoll-Rand Co., Ltd.	Separators— Darling Bros., Ltd. Smart-Turner Machine Co.	Surveying Instruments— W. F. Stanley. C. L. Berger.
Pumps—Electric— Darling Bros., Ltd. Smart-Turner Machine Co. Canadian Ingersoll Rand Co., Ltd. Fraser & Chalmers of Canada, Limited	Roasting Plants— Fraser & Chalmers of Canada, Limited	Sheets—Genuine Manganese Bronze— Hendrick Mfg. Co.	Tanks—Cyanide, Etc.— Fraser & Chalmers of Canada, Limited Hendrick Mfg. Co.
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	Rope—Wire— B. Greening Wire Co., Ltd. Allan, Whyte & Co. Northern Canada Supply Co. Fraser & Chalmers of Canada, Limited	Stamp Mills— Fraser & Chalmers of Canada, Limited	Turbines— Fraser & Chalmers of Canada, Limited
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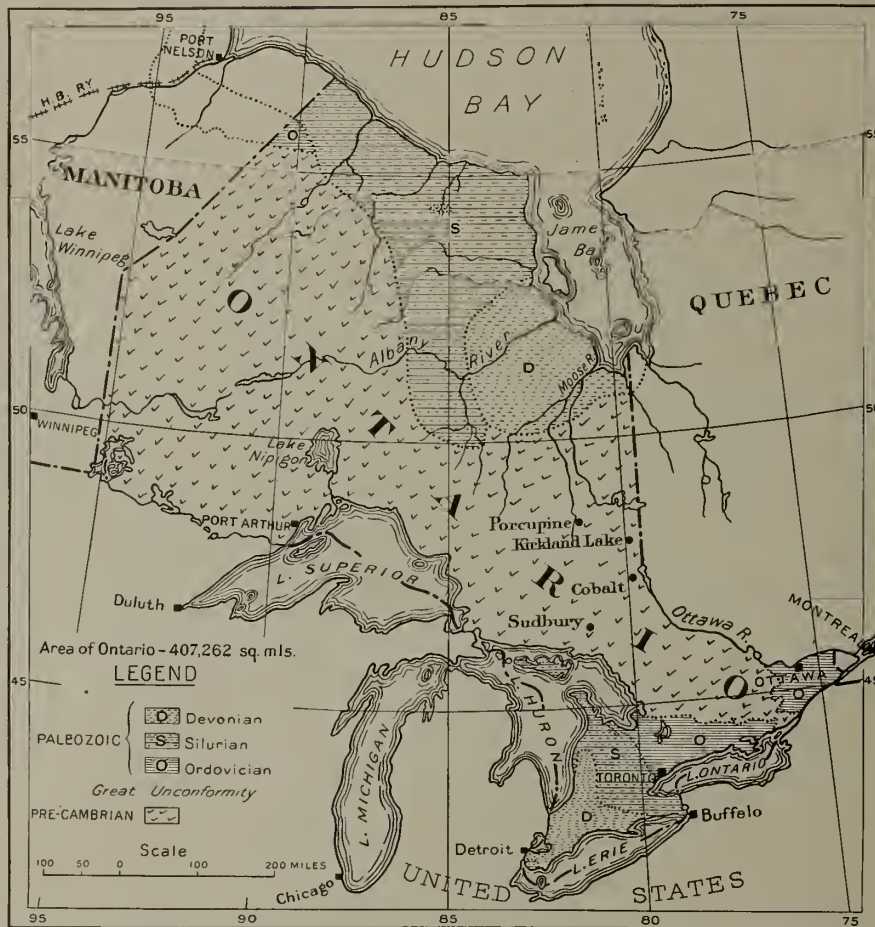
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Pre-Cambrian Products

Nickel
Silver
Gold
Iron
Copper
Cobalt
Pyrites
Arsenic
Quartz
Graphite
Talc
Feldspar
Mica
Corundum
Molybdenite
Trap
Marble
Fluorite



Paleozoic Products

Cement
Natural Gas
Brick
Limestone
Sandstone
Salt
Sewer-pipe
Petroleum
Tile
Lime
Gypsum
Calcium Carbide
Pottery

The products of the Paleozoic rocks come from southern Ontario, but some of these are known to occur in similar formations south of Hudson Bay. The metals occur pre-eminently in the Pre-Cambrian rocks of which only a small proportion have been prospected.

The rapid growth of Ontario's mineral industry during two decades under pre-war conditions is shown as follows:

1893, value, \$6,120,593

1903, value \$12,870,593

1913, value \$53,232,311.

Nickel-Copper

SUDBURY nickel deposits are the greatest in the world. Since the beginning of mining operations about 1885 up to the end of 1915 nickel-copper matte has been produced containing 237,202 tons of nickel and 146,661 tons of copper, besides considerable platinum, palladium, gold and silver. Taking nickel at 25 cents and copper at 10 cents per pound, the tonnage produced would have a value of \$147,933,200.

Production of nickel-copper matte for the first quarter of 1916 was 50 per cent. greater than in 1915. If the present rate is maintained about 40,000 tons of nickel and 22,000 tons of copper will be turned out by the smelters of the Sudbury area during 1916.

Gold

In 1915 Ontario produced from lode mines gold worth \$8,501,391, and since the year 1894 the province has assumed the leading position in gold output among the provinces of Canada.

PORCUPINE.—The chief gold camp, since its discovery in 1909 to the end of 1915, has produced 956,904 ounces of gold, worth \$19,767,902.

Kirkland Lake, Long Lake near Sudbury, Munro township, Cordova Mines in Eastern Ontario, and the Olympia in North-western Ontario were producers in 1915. At Boston Creek, Kowkash and Dryden promising gold finds have been made.

Silver

COBALT, with its phenomenally rich silver mines which were discovered in 1903, up to the end of 1915 produced ore containing 234,314,368 ounces of silver in addition to considerable cobalt, arsenic and nickel. Statistical returns to the Ontario Bureau of Mines for the first quarter of 1916 show a greater production than for the corresponding period of 1915 and a material increase in value owing to the high price of silver that has prevailed. Prospects that have been abandoned since the early days of the camp are being developed and low grade ore is receiving attention that at the low price prevailing in 1915 could not be profitably treated.

Ontario's Mining Lands

Ontario, with its 407,262 square miles of area, contains many millions of acres in which the geological formations are favourable for the occurrence of minerals, 70 per cent. of the rocks being of pre-Cambrian age.

The phenomenally rich silver mines of Cobalt occur in these rocks ; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie and Moose Mountain mines.

Many other varieties of useful products are found in Ontario :—cobalt, iron pyrites, arsenic, quartz, graphite, talc, feldspar, mica, corundum, molybdenite, platinum, palladium, actinolite, apatite, fluorite, salt, gypsum, petroleum and natural gas.

Building materials, such as cement, brick, marble, limestone, sandstone, trap, lime, sand and gravel, are abundant.

Ontario in 1915 produced over 44 per cent. of the total mineral production of Canada, or more than twice that from any other Province. The preliminary report of the Ontario Bureau of Mines shows the output of the mines and metallurgical works of Ontario for the year 1915 to be worth \$57,532,844, of which the metallic production was \$47,721,180. There were 79 producing mines, 62 of which operated at a profit.

The prospector can go almost anywhere in the mineral regions in his canoe ; the climate is invigorating and healthy, and there is plenty of wood and good water.

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